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	Page
Roentgen Diagnosis of Indurated Gastric Ulcer - - *By Dr. Lewis Gregory Cole, New York*	793
The Technic of Deep Roentgen Therapy - - - *By Drs. James T. Case, and Llewellyn L. Jones, Battle Creek, Mich.*	811
The Safe Interpretation of Roentgenograms of the Gall Bladder Region - - - - - - - - *By E. W. Caldwell, M.D., New York*	816
The Rôle of the Roentgen Ray in the Diagnosis of the Obscurer Forms of Heart Disease - - - - *By H. Wessler, M.D., New York*	820
Notes on the Diagnosis of Stomach Conditions by the Roentgen Ray - - - - - - - - *By H. W. Van Allen, M.D., Springfield, Mass.*	830
An Accessory Sinus Angle Finder - - - - - *By Frederick Manwaring Law, M.D., New York*	833
Editorial - - - - - - - - - - -	835
Correspondence - - - - - - - - -	836
Abstracts - - - - - - - - - - -	837

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THE AMERICAN JOURNAL OF ROENTGENOLOGY

Editor, P. M. Hickey, M. D., Detroit

VOL. II PUBLISHED NOVEMBER, 1915 Nos. 8-9-10

ROENTGEN DIAGNOSIS OF INDURATED GASTRIC ULCER

By DR. LEWIS GREGORY COLE, New York

IN this communication no attempt will be made to describe the roentgen findings in all types of gastric ulcer or to consider the very important question of the relation between gastric ulcer and early cancer. But we shall concentrate on one type of ulcer, namely, the indurated gastric ulcer.

The literature on gastric ulcers is practically limited to a description of the hour-glass stomach, Haudek's niche, and roentgen signs or symptom complices. Carman,* in a very excellent article on The Roentgen Diagnosis of Gastric Ulcer, published in the *American Journal of Roentgenology,* corroborates Haudek's observation regarding the niche, and very beautifully illustrates various types of the niche with and without the incisura; he carefully describes other Roentgen signs or symptom complices such as incisura, hour-glass stomach, residue, lessened mobility, tender point, delayed pyloric opening, acute fish-hook, hypotonicity, and antiperistalsis. But in closing he emphasizes the fact that the niche and the accessory pocket are the only conclusive signs of gastric ulcer.

Symptom complices or roentgen signs are a group of the usual clinical symptoms detected by an unusual method of examination and are not much more accurate than the clinical symptoms as detected by the history and physical examination and by gastric analysis. The diagnosis of ulcer by means of symptom complices is, I believe, of practically no value in comparison with the direct evidence of the lesion and not even worthy of mention in the same paragraph with hour-glass stomach and Haudek's niche.

The hour-glass deformity of the stomach from cicatricial contraction of an old ulcer is so characteristic and so well known in both medicine and surgery and in roentgenology that we shall merely mention it, using one characteristic roentgenogram as an illustration (Fig. 1). But it must be differentiated from spasmodic hour-glass, or an unusually deep peristaltic contraction.

Haudek's niche is an accumulation of bismuth or barium which has emerged through a penetrating ulcer and been walled off in a pouch on the lesser curvature or posterior wall of the stomach. With the patient in the erect posture the barium gravitates to the bottom of the pouch and is surmounted by a bubble of gas. This niche is even more characteristic of ulcer than is the hour-glass contraction of the stomach.

In 22 cases out of 30 reported by Carman the diagnosis was based on the presence of the niche, and in every one of these cases the niche was shown as distinctly as it is in Fig. 2 of this article. Yet in my own personal experience in examining 1,000 cases I have not observed in a single case of non-malignant gastric ulcer such a niche as

* Carman: *Amer. Jour. of Roent.*, April, 1914, Vol. I, No. 6, p. 233.

FIG. 1. Non-malignant hour-glass contraction without Haudek's niche.

Haudek described or Carman so graphically illustrates, and I am therefore compelled to borrow the illustration (Fig. 2) from Holding, who made the examination at General Memorial Hospital, with which we were both associated at that time. I have many cases such as is presented in Fig. 3 where the niche was perfectly shown but in every one of these the lesion was proven by surgical procedure to be malignant, or the patient went on without operation and died within a few months with symptoms of gastric cancer.

With either the hour-glass contraction or Haudek's niche the deformity of the stomach is so great that it may be readily recognized fluoroscopically or roentgenographically and although I have never detected a single case of typical Haudek's niche in a non-malignant ulcer, nevertheless, during three months, while examining only 45 cases, I detected 5 cases of the indurated type of ulcer such as I am about to describe. It is therefore evident that in my private practice indurated gastric ulcer with or without a niche or slit-like fold is far more frequent than the Haudek's niche. I suspect that, after all, the difference between these two conditions is only a question of degree and that in the early stage there is induration with a minute slit-like crater which either heals leaving a localized

area of induration or, if the ulcer does not heal, increases in depth and diameter, until it gives the typical Haudek's niche shown in Fig. 2 and Fig. 3. By that time, however, the great majority of the ulcers will have become malignant.

If the cases to be examined roentgenologically are selected from those which have gastric symptoms sufficiently characteristic and severe to warrant surgical procedure, such as the cases that are examined in the surgical ward of hospital and surgical clinics, a relatively large number of them would undoubtedly have reached the stage of the Haudek's niche or hour-glass contraction. But if the cases are selected from those which are re-

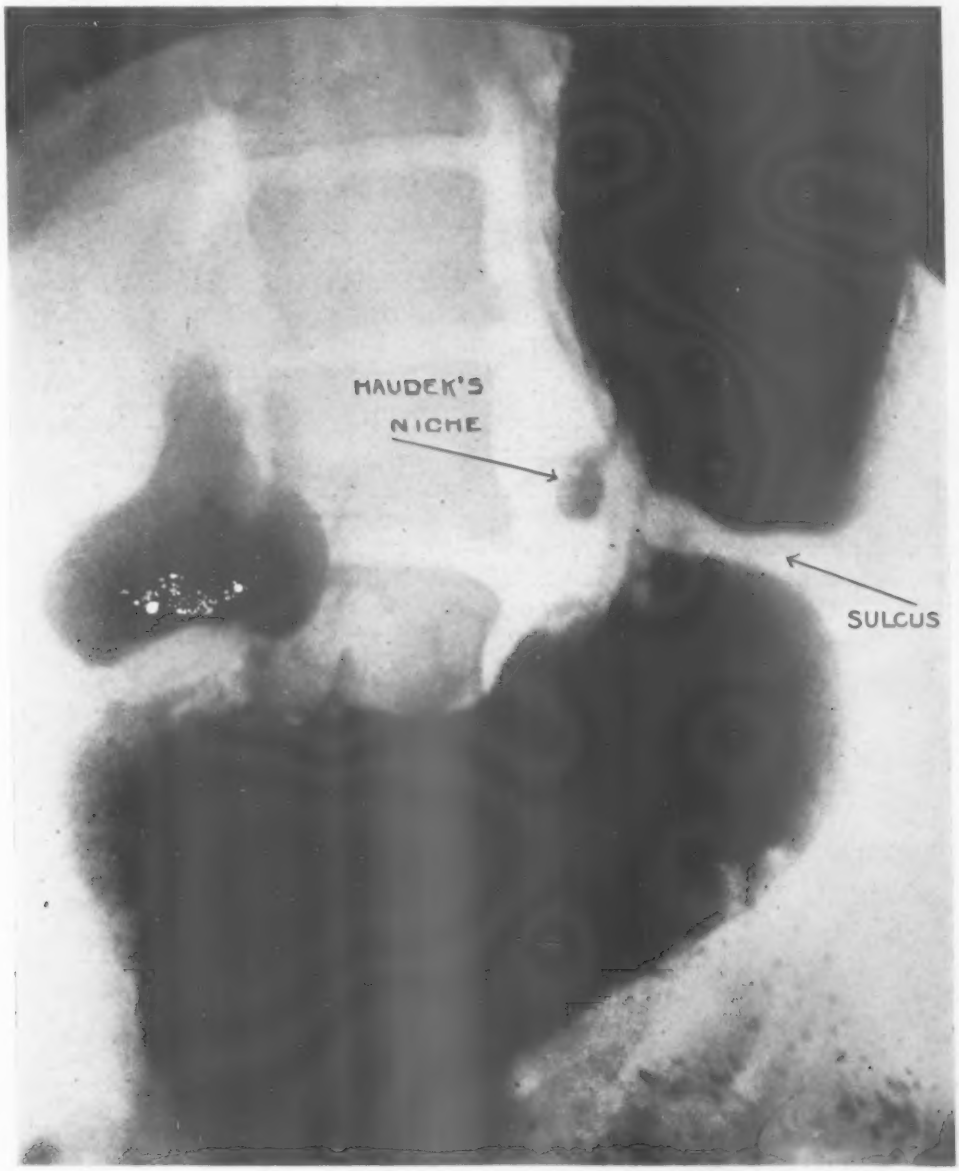

FIG. 2. Non-malignant hour-glass contraction with Haudek's niche.

ferred by physicians, and present themselves in the routine course of examination with obscure symptoms that are not sufficiently characteristic or severe to justify one in even considering surgical procedure, such cases would show, as has been proven by experience, very few examples of classical hour-glass contraction or Haudek's niche. Considering that these extensive lesions occur in such a relatively small percentage of the cases of gastric ulcer, it is evident that these findings are present in only a certain type of ulcer and if we depend wholly on them, only a small number of ulcers, namely, those which are advanced, can be diagnosed by the roentgen method of examination.

My principal object is to describe and emphasize the important roentgen findings

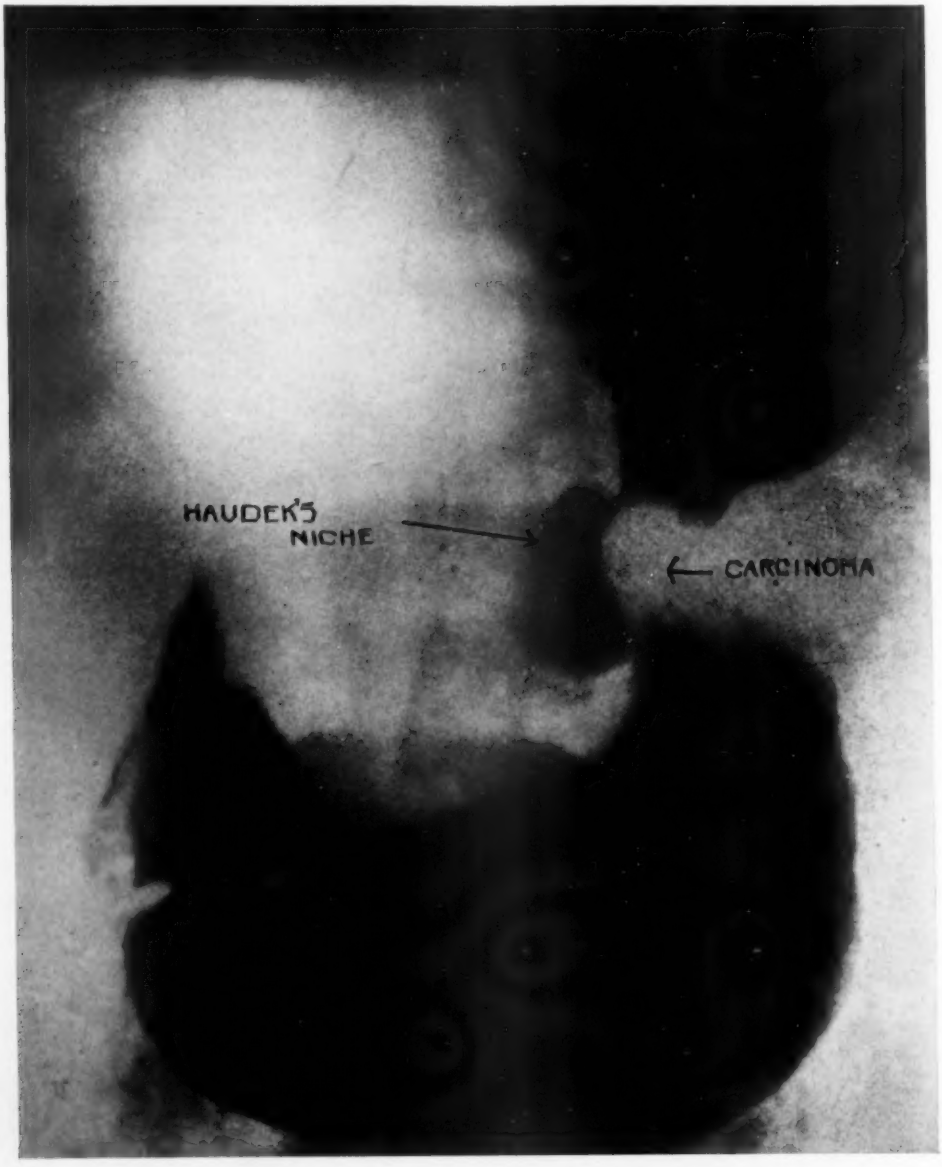

FIG. 3. Malignant hour-glass contraction with Haudek's niche.

which are characteristic of indurated gastric ulcer at a far earlier stage than is Haudek's niche or hour-glass contraction.

The term "indurated gastric ulcer," as employed in this and succeeding communications, is applied to any ulcer, either active or inactive, which is surrounded by an amount of exudate into the submucosal and muscular coats, sufficient to make the induration detectable at direct palpation of the wall of the stomach during surgical procedure or necropsy. That is, any ulcer that can be seen or felt during a surgical procedure or autopsy without opening the stomach and examining its inner surface.

In this type of indurated ulcer there may or may not be a crater; it makes no difference in the diagnosis, but if present it is a very small streak or slit and involves only the mucosal, submucosal, and possibly the muscular coats, but it does not form the pouch into which bismuth gravitates to the bottom and it is not surmounted by a bubble of gas.

There are other types of gastric ulcer which are simply mucosal erosions with such a slight amount of induration that the ulcer cannot be detected by direct palpation of the wall of the stomach and can be observed only by opening the stomach and examining the mucosal surface. This mucosal erosion may be detected by serial roentgenography with a remarkable degree of accuracy but its roentgenological characteristics will not be described in this article.

The method of examination is that of serial roentgenography, the technique of which has been extensively described in previous communications * and the cases which are shown in this article are simply the "proof of the pudding." For the sake of those not familiar with the fundamental principles of this method of examination, I will state that serial roentgenography is the making in rapid succession of forty to fifty roentgenograms of the stomach with the patient in various positions (prone, erect, supine, and oblique). These radiograms are studied individually and collectively and either matched over each other or reproduced cinematographically, and by such a study of them one notes the progress of the peristaltic ring as it advances pyloruswards. By this method one can detect small areas of induration which render a localized area of the wall of the stomach less pliable than normal or than other portions of the stomach. This pliability is determined by noting the depth and width of the peristaltic rings and whether they are obstructed in any localized area as they progress pyloruswards. One must be familiar with the appearance of the normal gastric peristalsis in all its variations, especially that shown in Fig. 14, before he attempts to interpret variations from the usual as pathognomonic of gastric ulcer. A simile which I have frequently used in describing this roentgenological indication of localized induration is the appearance caused by the tying of a string tight around an inflated automobile tire. If the tire is of uniform thickness the string will sink into it uniformly on all sides, but if the string is tied over an area where a patch has been applied, its indentation at that point will be less than on the opposite side. So with the gastric peristalsis when it reaches the "patch" of induration. It is materially interfered with and one may even observe a compensating increase in the depth of the sulcus on the opposite side of the stomach.

The roentgen findings in cases of indurated gastric ulcer of the lesser curvature of the stomach with or without a crater are so similar that they give us a very classical roentgen finding which is as pathognomonic of indurated gastric ulcer as is Haudek's niche of the more extensive penetrating ulcer.

But of the nine cases to be reported on, we will select one for a more careful consideration comparing with it the other eight cases.

* Relation of Lesions of the Small Intestines to Disorders of the Stomach and Cap as Observed Roentgenologically. *Amer. Jour. of the Med. Sci.*, July, 1914.

The Complex Motor Phenomena of Various Types of Unobstructed Gastric Peristalsis. *Archives of the Roent. Ray*, December, 1911.

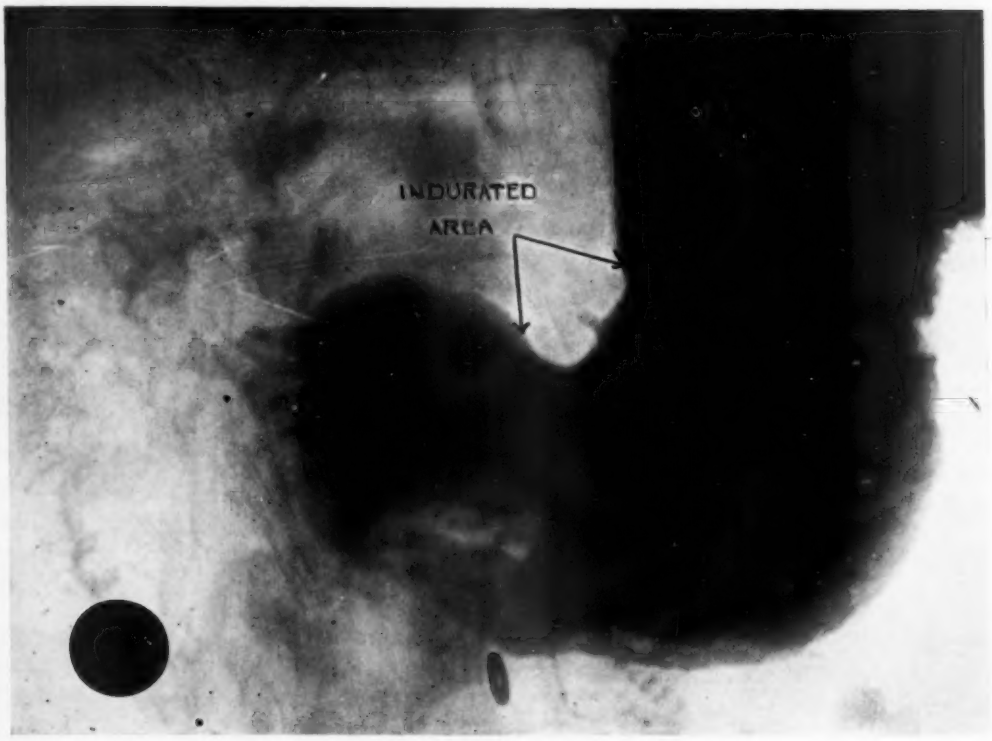

FIG. 4. Slightly indurated ulcer with slit-like crater.

CASE IV. MRS. X, THE WIFE OF A WELL-KNOWN SURGEON (FIG. 4)

This case is chosen for the following reasons:

1. It is the most typical of the small indurated ulcer.
2. It more closely resembles a certain stage of gastric peristalsis.
3. She had been under observation for three years without the presence of the ulcer being suspected.
4. Immediate surgical procedure was indicated.
5. When the surgeon opened the abdomen and examined the stomach there was no evidence of ulcer on inspection and only slight evidence by touch.
6. The ulcer was excised and proven non-malignant.
7. The patient made a complete recovery.

The following roentgen diagnosis is copied verbatim from the writer's report sent to the attending physician:

> From a study of these roentgenograms I believe we are justified in making a positive diagnosis of an ulcer of the lesser curvature of the stomach, about three inches from the pyloric sphincter, which requires immediate surgical procedure. This ulcer shows a tendency to perforation which to my mind would not justify any material delay.

I refused to finish the remaining portion of the following is a quotation verbatim from the husband of the woman, a surgeon, who was present at the operation:

> I might recall to your mind the fact that Mrs. ——'s history contra-indicated ulcer in every particular,—so much so that the very best men in town refused to believe that an ulcer was present until you located it with the X-ray. It was found midway between the pylorus and oesophagus on the lesser curvature, and was entirely free from perigastric adhesion and, therefore, removable. It could not be felt by palpation through the walls of the

tion of the intestinal tract, because I did not consider the delay justifiable.

stomach, but on the strength of your positive diagnosis the stomach was opened, and then by everting the mucosa through this incision the ulcer could be seen. It was about the size of a five-cent piece and had penetrated through the mucosa and muscularis to the peritoneum. It is non-malignant, another confirmation of your diagnosis.

The following is a letter received from Dr. Deaver, the surgeon who operated in the case:

". . . I take pleasure in writing you the findings in the case of Mrs. X, upon whom I had the pleasure of operating last Saturday; a small ulcer on the lesser curvature of the stomach, midway between the œsophagus and the pylorus, involving the mucous, submucous and muscular coats. There was no infiltrate of the serosa, therefore, no demonstrable evidence of ulcer by eye, only by touch, which was very slight; yet I felt warranted in opening the stomach, which resulted in exposure of the ulcer. I excised the ulcer and took out the appendix. My heartiest congratulations on your skillful X-ray work. . . ."

This patient had been observed for three years, yet the clinical symptoms did not even suggest gastric ulcer and even after the roentgen examination when a definite roentgen diagnosis of indurated gastric ulcer had been made with a recommendation for immediate surgical procedure there was so little clinical evidence of the gastric ulcer that the operation was deferred for more than a month.

An opinion as to the non-malignancy of the ulcer was expressed to the patient's husband but not included in my report. The ulcer was excised and proven non-malignant by microscopical examination. The patient made an uneventful recovery and at the present time is perfectly well.

The roentgen indications of small indurated gastric ulcer were so characteristic that there was not the slightest question in my mind of the diagnosis, yet when the abdomen was opened there was no visible evidence of the ulcer and on palpation the induration was so slight that when the attention of the surgeon was centered on a definite localized area the correctness of the diagnosis was questioned.

When one considers the detail that can be observed roentgenographically, it is not remarkable that a positive diagnosis could be made in this manner in spite of the fact that the ulcer was so imperceptible to palpation as to cast a doubt in the surgeon's mind. Surgeons know that by palpation of the pylorus it is extremely difficult to detect the pyloric sphincter and Mayo emphasized this point by stating that the only way the position of the pyloric sphincter can be definitely determined at operation is by its constant relation to the pyloric vein. Yet the roentgenological evidence of the pyloric sphincter itself is a beacon that stands out like a lighthouse to guide the roentgenologist. Not only the presence of the sphincter but the roentgenological appearance of the surfaces and whether the lumen is centrally located are the fundamental principles upon which is based the detection of small ulcers and the determining of whether they are pre-pyloric or post-pyloric.

The rugae of the gastric mucosa are as definite as the whorls on a person's thumb and the criminal could be as accurately identified by one as by the other. Yet, can the surgeon detect by palpation these individual folds of the mucosa? Another surgeon who was present at the operation reported that "the mucous membrane was puckered about the ulceration so as to form a slight depression." That puckering of the mucosa is definitely shown in Fig. 4 running down across the wall of the stomach.

Therefore, is it remarkable that an indurated area, "the size of a nickel" (as the surgical report states) should show? For comparison, a circle the size of a nickel is reproduced in the lower corner of Fig. 4.: note how closely it corresponds in size with the induration shown in the radiogram.

This case is especially interesting because it so closely resembles a certain stage of the normal gastric peristalsis. Compare Fig. 4 in which a definite diagnosis of ulcer was made, with Fig. 14, which is a perfectly normal phase of the gastric cycle. From single plates it would have been absolutely impossible to differentiate these conditions. Recently, six, out of twelve radiograms of a case, showed this particular phase of gastric cycle so constantly that it would have been absolutely impossible to define it as the normal peristalsis and not an ulcer, unless the other radiograms of the series had shown its progression pyloruswards.

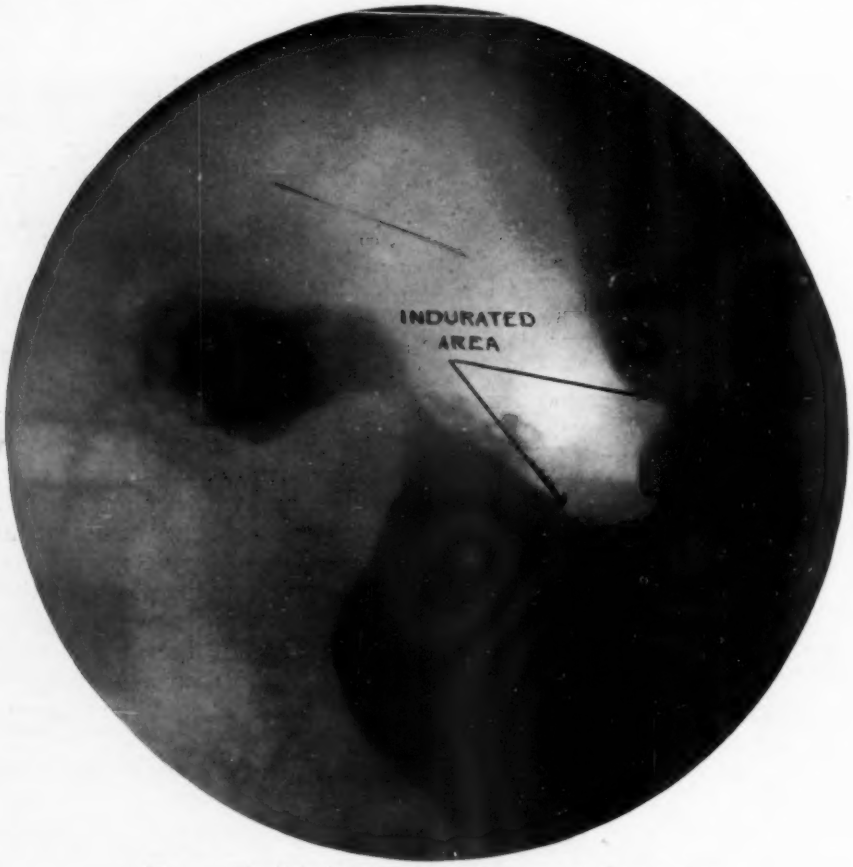

FIG. 5. Small indurated ulcer with very shallow crater.

CASE V. WOMAN (FIG. 5)

The onset of the symptoms occurred eight years ago, since which time there had been a history of pain in the epigastrium and across the lower chest, recurring at intervals of several years and lasting from one to four months. The last attack was two months before the examination. Her appetite was not good; there was also some belching, but no regurgitation, vomiting or haematemesis and very little nausea. The pain across the abdomen became worse after eating. There was no burning, soreness, tumor, or jaundice, but the patient was very constipated, and had lost weight during the last fourteen months.

Roentgenologically, this case and the preceding one were almost identical. The induration was a trifle more extensive in this one but not so thick, and the crater was larger in diameter but not so deep. There had undoubtedly been an indurated ulcer

area at this point for eight years and at the period when it gave symptoms the crater was open or active.

This patient refused operation, and six months later is so completely free from symptoms that the physician states: "This is a case where the X-ray probably is wrong."

Fortunately this is a case which can probably be followed indefinitely and, if she continues to refuse operation, will be rendered extremely valuable in determining whether malignancy is ingrafted upon this type of ulcer, and whether the crater deepens, so as to form a pouch or niche such as Haudek's niche.

FIG. 6. Small indurated ulcer with very shallow crater.

CASE VI. S. MAN (FIG. 6)

CLINICAL HISTORY: The attack, which had begun some seven months previously, was characterized by pain across the body in line with the epigastric region. This pain, which was intermittent, was accompanied by soreness, but the appetite was very good, and there was no history of belching, regurgitation, or nausea. There had been one slight attack of vomiting.

ROENTGEN DIAGNOSIS: "From a study of these roentgenograms I feel justified in making a negative diagnosis of an extensive carcinoma and of an extensive induration of the stomach and cap. The small perforating ulcer on the posterior wall of the stomach shows such slight evidence of induration that I believe there is a possibility of its being missed at the operation unless the stomach is opened."

This patient refused operation temporarily but I hope to obtain confirmation later, from surgical procedure or another set of radiograms to determine the progress of the ulcer. The roentgenologic findings in the case correspond so exactly with those of Case IV, that there is absolutely no question of the diagnosis. Therefore, if we

can follow this case, it will make history, particularly if it is not operated on. It is only by following the cases roentgenographically that one can determine whether the crater of an ulcer heals or goes on to carcinomatous degeneration; therefore, the important thing is to follow up the cases.

A just criticism of this article would be that sufficient cases are not proven by surgical procedure. These cases, so far not proven, have all been detected within the last year and perhaps some of them will come to surgical procedure. But if you will read between the lines in the case illustrated by Fig. 4 you will see that any but the most careful surgeon whose attention has been directed to some specific point in the wall of the stomach might readily miss an indurated ulcer which was not visible and whose induration was as slight as that described by Dr. Deaver.

In the future it will be proven conclusively that the findings here described are as pathognomonic of this type of ulcer as the Haudek's niche is of the more advanced ones. Therefore, those cases which refuse operation and can be followed roentgenographically are of infinitely more importance than those operated on, because in this way the percentage of indurated gastric ulcers that go on to carcinomatous degeneration can be conclusively proven.

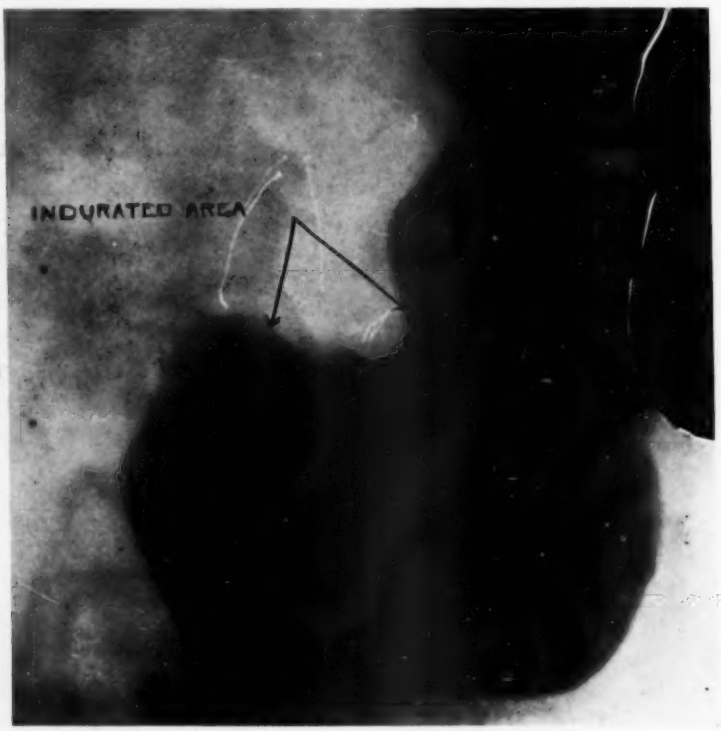

FIG. 7. Small indurated area without crater.

CASE VII. M. MAN (FIG. 7)

CLINICAL HISTORY: Some three years before this patient presented himself for examination he suffered an attack of indigestion accompanied by belching, nausea, and some vomiting. These attacks were frequent until the employment of an abdominal belt, after which the symptoms disappeared. Just prior to his presenting himself he had had another attack of vomiting lasting four days, with some abdominal pain, since which time he had felt well.

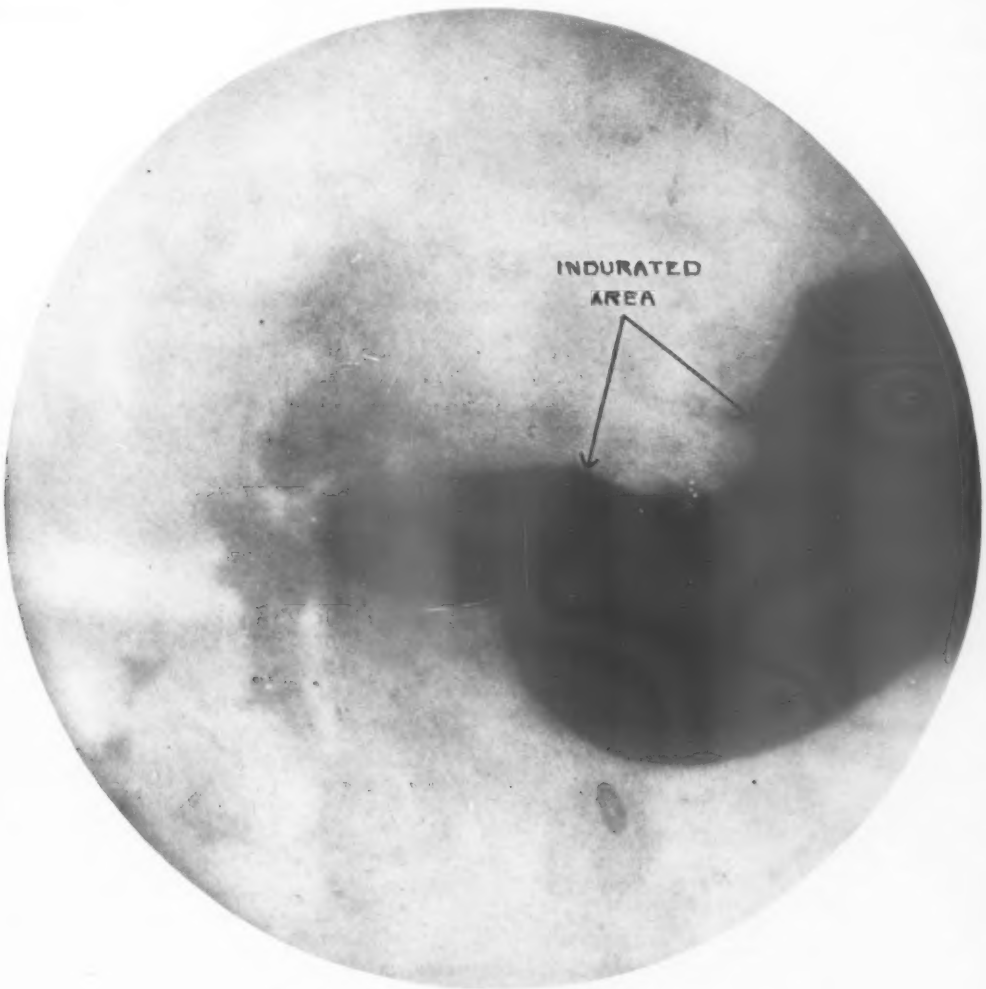

FIG. 8. Small indurated area without crater.

ROENTGEN DIAGNOSIS: A constant deformity shown on the lesser curvature of the stomach was evidence for a positive diagnosis of an indurated ulcer about an inch and a half from the pyloric sphincter, and perhaps involving the cap, with every possibility of its becoming malignant at any time; immediate surgical procedure was advised, regardless of the clinical history.

SURGICAL FINDINGS: On opening the abdomen and examining the stomach the surgeon found slight adhesions involving the lesser curvature and cap and one band not very dense extended down across the pars pylorica. This adhesion radiated from an area on the lesser curvature of the stomach. At this point there was a small area of induration about the size of a penny. The stomach was opened and on the lesser curvature there was a small slit-like scar about an eighth of an inch wide and one-half inch long. This was directly in the center of the indurated area. Considering the age of the man and the probability of this indurated area becoming malignant, it was excised; the patient made an uneventful recovery.

This case proved that roentgenographically one can detect small indurated areas

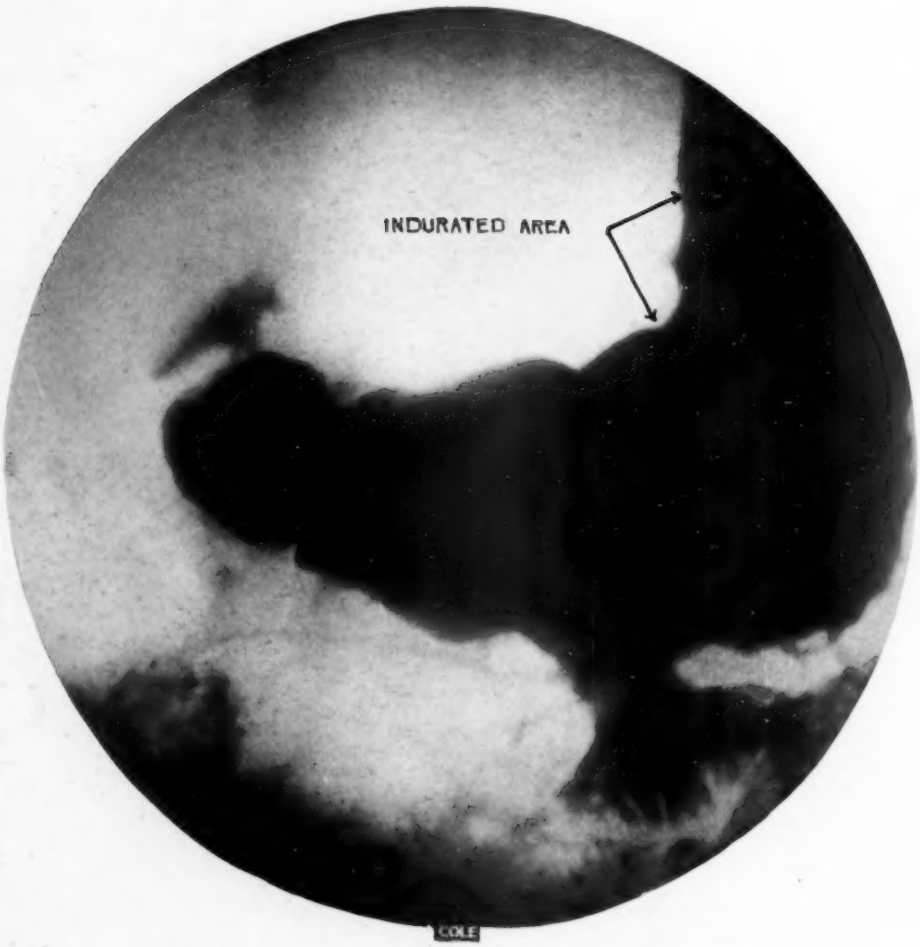

FIG. 9. Small indurated area with very slight crater.

resulting from an ulcer even when the mucosal defect is completely healed, and there is no crater or niche whatever. This case, while extremely gratifying in confirming the findings even to the drag of the adhesions across the anterior surface of the stomach, would have been of still greater scientific interest if this patient had refused operation and we could have examined him from time to time to determine whether the crater formed at the time the symptoms were aggravated and whether it would go on to malignancy. A surgeon has only to see one or two such cases to be assured of the accuracy with which these minute lesions can be detected.

A report made this day by the physician in charge of the case states that by the excision of the ulcer the patient has been entirely relieved of the symptoms.

CASE VIII. S. MAN (FIG. 8)

This was a dispensary case and the clinical history was not obtained. The roentgen examination revealed a localized area on the lesser curvature of the stomach about an inch and a half from the pyloric sphincter, where the peristaltic contractions were interrupted in their progress pyloruswards. A diagnosis of indurated ulcer with the possibility of malignancy was given.

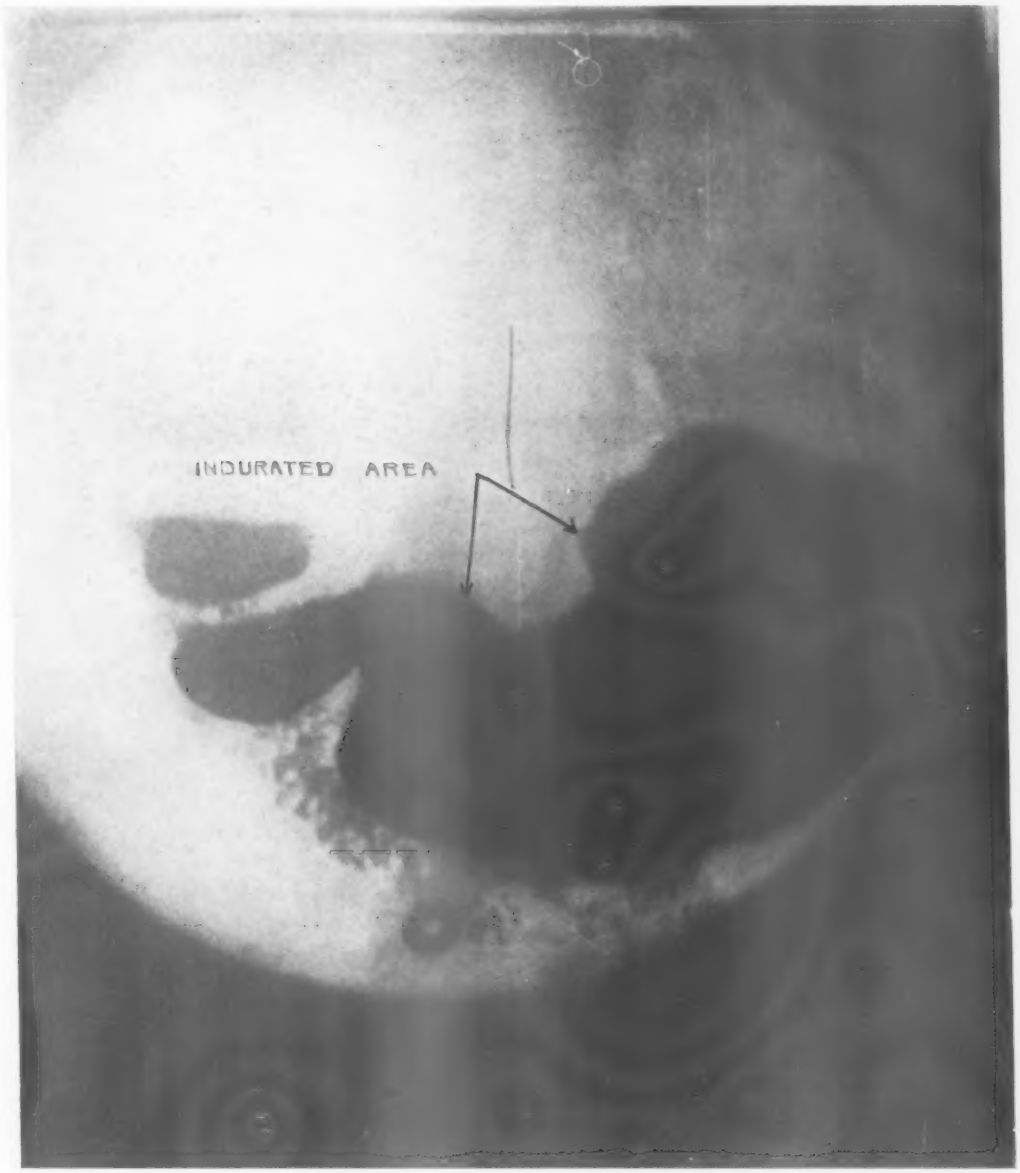

FIG. 10. Indurated area without crater.

Subsequent history is not known. Therefore, all the work of a serial roentgen examination has been of no value, a result more likely to occur with this class of patients than with private patients.

CASE IX. R. MAN (FIG. 9)

This case was examined about three years ago to determine how a gastroenterostomy which had presumably been performed for an ulcer was functionating at that time. Although a series of roentgenograms were made, I did not note the definite localized area of induration. The method was right and the roentgenographic evidence was there, but I was unobserving and did not interpret the findings. Three years later while studying these cases of gastroenteros-

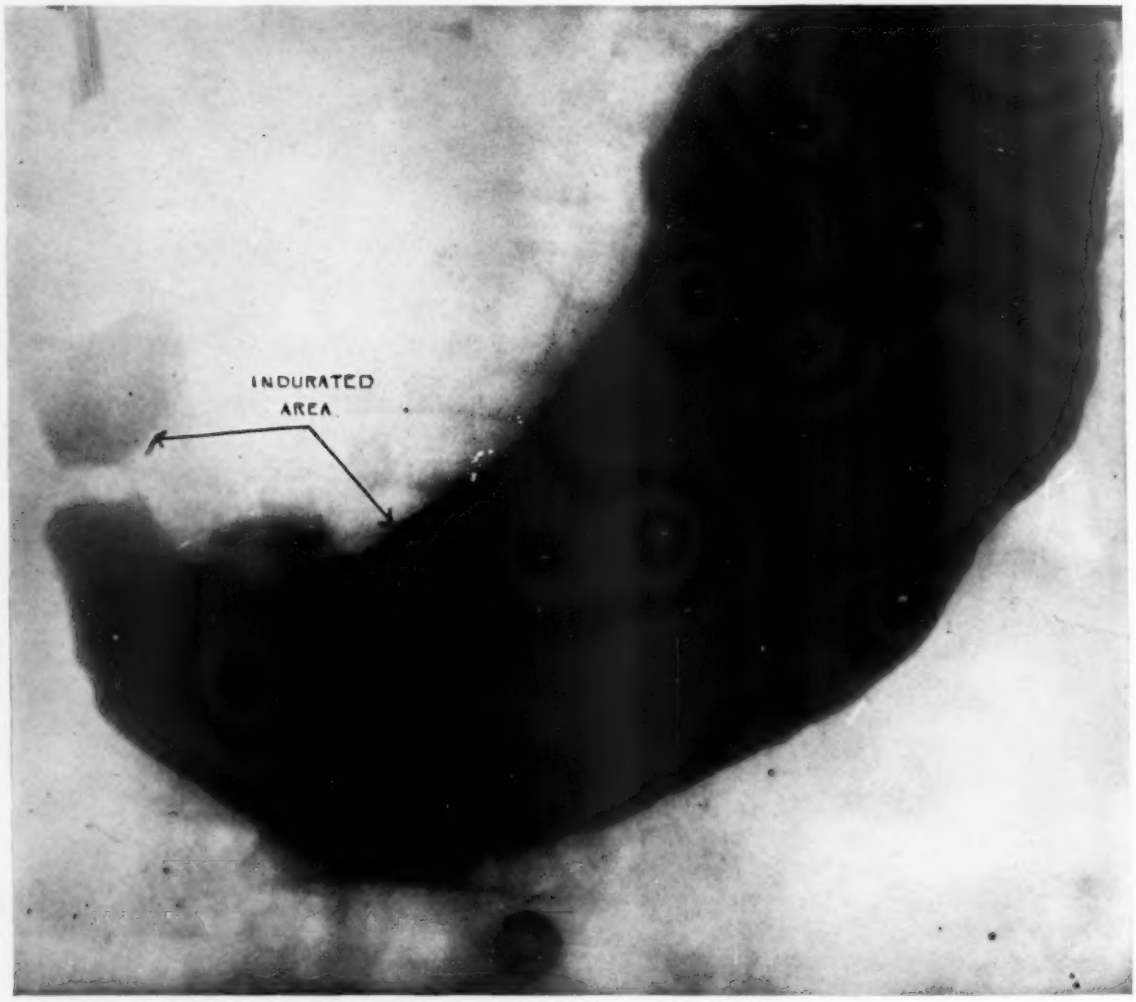

FIG. 11. Indurated area with depressed crater.

tomy I recognized the definite evidence of the indurated gastric ulcer of the lesser curvature. This patient, like the preceding one, had had periods of exacerbation of the gastric symptoms, and at other times was completely free of symptoms, but up to the present time there have been no clinical indications of the ulcer's having become malignant. I have not yet succeeded in getting subsequent radiograms to determine whether the induration has increased. Gastroenterostomy failed to relieve this patient of his gastric symptoms, while excision of the ulcer in Figures 4 and 7 completely relieved the patient of all symptoms. Therefore, this particular case would seem to indicate that gastroenterostomy for this type of ulcer is not so satisfactory as excision.

CASE X. V. E. WOMAN (FIG. 10)

CLINICAL HISTORY: The symptoms which had developed some four months previous to the examination consisted of considerable nausea and vomiting during the first three months, and pain later, with some soreness and loss of weight.

ROENTGEN DIAGNOSIS: The inability of

the lesser curvature to expand and contract, and the deep sulcus, of a constant size and shape observed about 2½ inches from the pyloric sphincter, was definite evidence of an indurated area, either from an old ulcer or the beginning of a malignant process. It was considered sufficient to warrant surgical procedure.

SURGICAL FINDINGS: The operation confirmed the X-ray diagnosis. An indurated ulcer, probably malignant, and about two inches in diameter, was found on the lesser curvature, extending so far up toward the cardia that complete excision was not done. A posterior gastroenterostomy was performed.

LATER REPORTS: January, 1913 (three months after operation), patient continues entirely relieved of symptoms since operation.

November 5, 1913.—Patient still under observation. No definite opinion as to malignancy.

About two years after the operation there was a return of the symptoms with nausea and vomiting of blood that made the physician suspicious of malignancy, but there was no definite report as to her condition.

CASE XI. V. G. MAN (FIG. 11)

CLINICAL HISTORY: This man was a heavy smoker, but not a user of alcohol. The onset of his symptoms had been gradual, lasting about three months. His appetite was good; there was no belching, regurgitation, nausea, or vomiting, but there had been moderate epigastric pain three hours after eating. There was no change in his weight.

ROENTGEN DIAGNOSIS: An area of infiltration with a depressed center on the lesser curvature, extending from the pyloric sphincter to a point about two inches from the sphincter gave strong evidence of a lesion at this point. Although its malignancy could not be determined by roentgen examination, surgical procedure was strongly advised. At the consultation the clinical history and physical examination did not confirm the roentgen findings and the surgeon said he could not conscientiously operate on the case. The patient and the roentgenologist assumed the responsibility for the operation and the surgeon consented to perform it.

SURGICAL FINDINGS: An indurated ulcer of the lesser curvature near the pylorus was found. A specimen was examined microscopically and no evidence of malignancy was found.

CASE XII. C. MAN (FIG. 12)

CLINICAL HISTORY: Unknown.

ROENTGEN DIAGNOSIS: The following is a copy of the report in this case: From a study of these plates there is evidence of a partial pyloric obstruction. This is probably due to an indurated ulcer, or cicatricial contractions of an ulcer. The possibility of this being malignant at the present time or becoming so, combined with the retention of the food twenty-four hours after its ingestion, indicates surgical interference. The excision of the involved area in this region might give good results in the cure or prevention of a carcinoma.

SURGICAL PROCEDURE: The symptoms were relieved temporarily by resection of the sympathetic nerves of the lesser curvature of the stomach.

SUBSEQUENT HISTORY: The symptoms returned and were relieved by an operation in which there was a resection of the pylorus. No evidence of malignancy was detected. Later the patient became addicted to drink and, the symptoms again returning, he came back with clinical symptoms of an ulcer of the duodenum. He was treated medically, became improved, and left the hospital apparently cured.

CASE XIII. O'B. MAN (FIG. 13)

CLINICAL HISTORY: Unknown.

ROENTGEN DIAGNOSIS: The report reads as follows: From a study of these plates there is evidence of a definite lesion involving the extreme pyloric end of the lesser

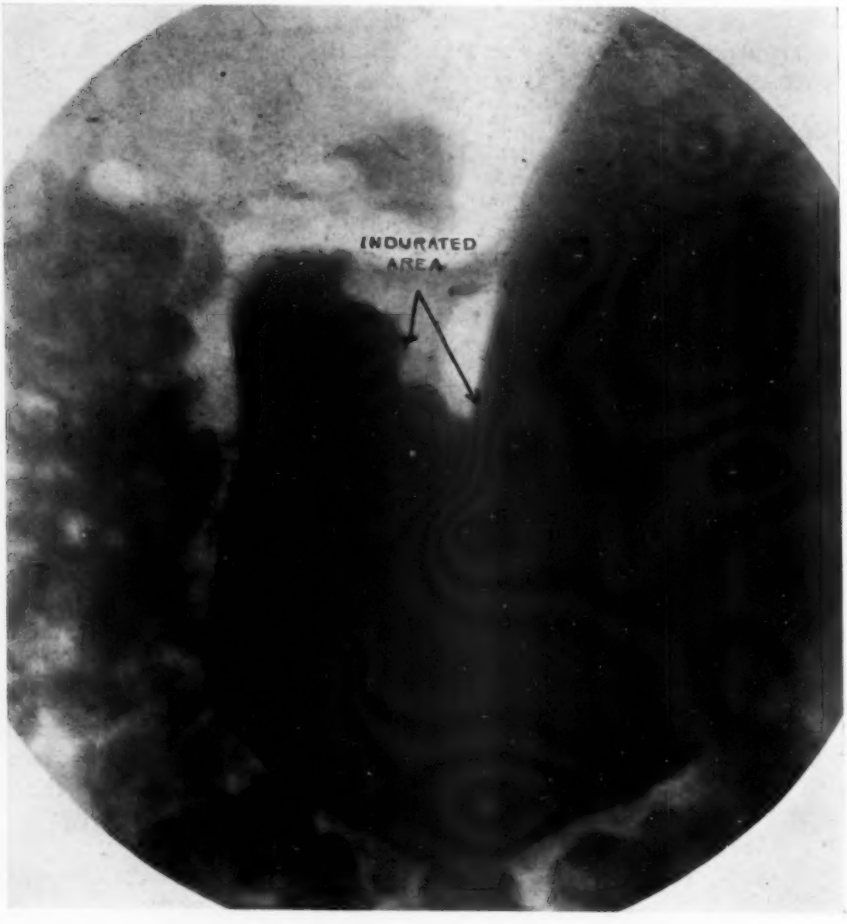

FIG. 12. Indurated area without crater.

curvature, causing a retraction of the cap anteriorly. This corresponds with a duodenal ulcer, but the radiographic findings indicate that most of the induration involves the stomach, rather than the duodenum, although the lesion may have started in the duodenal surface of the pyloric sphincter. There is no evidence of obstruction. Whether or not there are any carcinomatous changes at the base of this ulcer can only be determined by a microscopic examination.

SURGICAL FINDINGS: The stomach was moderately dilated. The pylorus was thickened and covered with adhesions old and new. Ulcer was found in the first portion of the duodenum, on the anterior surface, just beyond the pylorus.

This ulcer is so close to the cap that the surgical report indicates that it is just beyond the sphincter, but the sphincter as a landmark is so much more definitely determined roentgenographically than it is surgically where one must assume that it is just opposite the pyloric vein that the roentgen location is even more accurate than the surgical findings. A factor well worth consideration is the great similarity between this ulcer at the sphincter and that of Case IV at the angle of the lesser curvature of the stomach.

A normal stomach showing a phase of

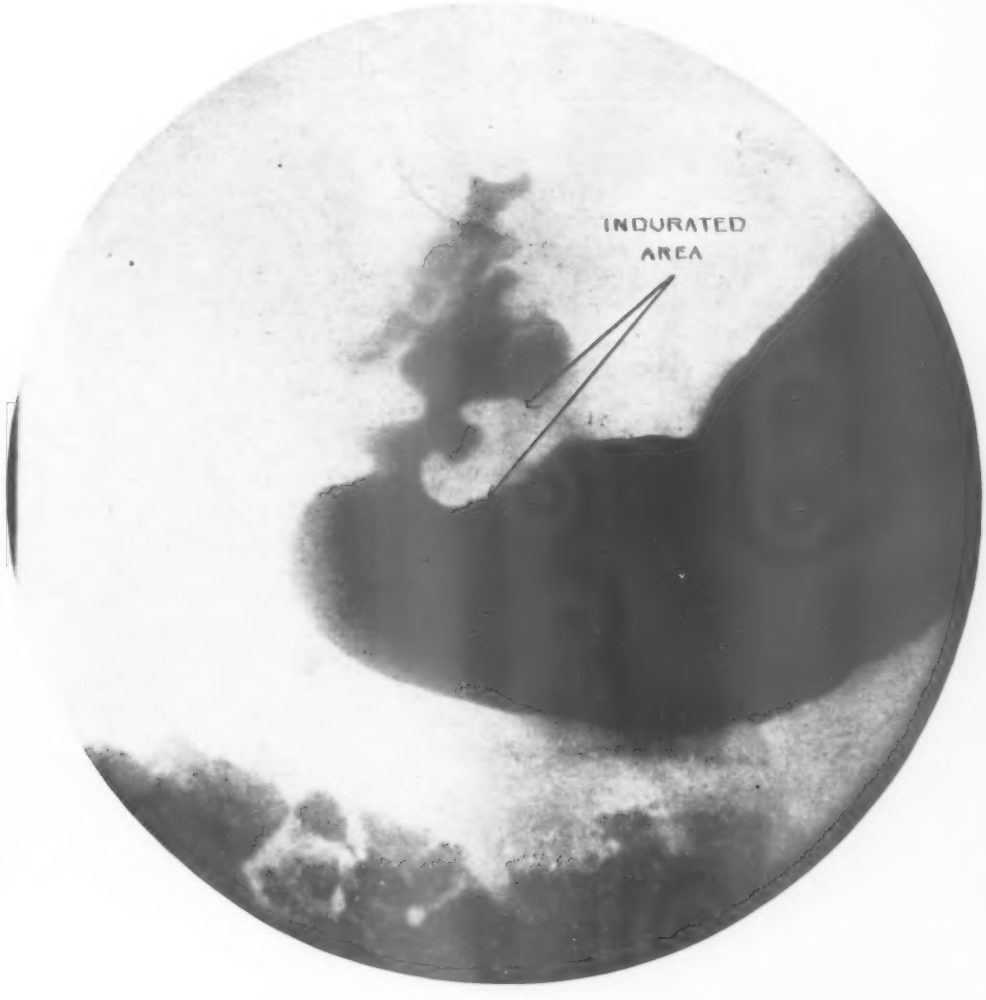

FIG. 13. Indurated area with bullet-hole crater.

gastric cycle very closely resembling the indurated gastric ulcer in Case IV is illustrated in Fig. 14. This is similar that only by a study of this phase compared with other phases as observed in the series is one able to state whether it is an ulcer or the peristalsis of a normal stomach.

So far as the cases could be followed those in which excision of the ulcer was done have been completely relieved of their symptoms. Those in which a gastroenterostomy was performed have been only temporarily relieved of their symptoms. Those in which pylorectomy was performed were better than those undergoing gastroenterostomy. One of the cases in which nothing was done surgically is free from symptoms at the present writing. As this article was primarily to show the value of serial roentgenology in the detection of small indurated ulcers before they reach the stage of the typical Haudek's niche, we shall simply mention the results of the various surgical procedures and not draw any conclusions from them.

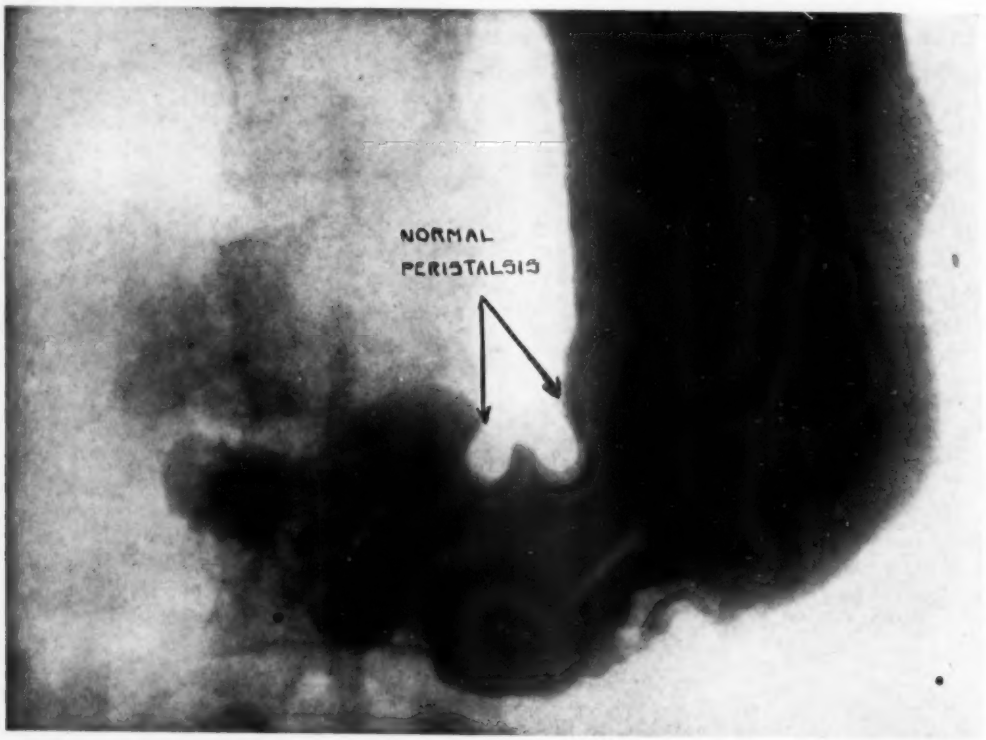

FIG. 14. Normal peristalsis resembling indurated ulcer.

RÉSUMÉ

1. No attempt is made to consider the very important question of the relation between gastric ulcer and carcinoma.

2. Literature on gastric ulcer is practically limited to a consideration of Haudek's niche and hour-glass deformity of the stomach, which are of great value, and symptom complices, or roentgen signs, which are of very little value.

3. Haudek's niche and hour-glass stomach are found in advanced ulcers, many of which, in the author's experience, are already malignant.

4. The object of this communication is to emphasize the fact that indurated gastric ulcers may be detected at a far earlier stage than the Haudek niche and hour-glass contraction.

5. The term "indurated gastric ulcer" is applied to any ulcer that can be seen or felt at operation without opening the stomach and examining the mucosa.

6. There are other types of gastric ulcer, such as mucosal erosions with slight induration, which can be detected, but these are not included in this article.

7. Indurated gastric ulcers with or without a slight niche are much more frequent in the author's cases than the more advanced cases of Haudek's niche or hour-glass stomach.

8. The method employed for the detection of indurated gastric ulcer is serial roentgenography, which is briefly described.

9. Great care must be observed not to interpret certain phases of the normal gastric cycle as an indurated gastric ulcer.

10. The roentgen findings of indurated gastric ulcer are as pathognomonic of the early small ulcer as the Haudek's niche is of the penetrating lesions.

This article is illustrated with 14 roentgenograms showing the typical findings of indurated gastric ulcer compared with perforating ulcer and normal stomach.

THE TECHNIC OF DEEP ROENTGEN THERAPY *

By JAMES T. CASE, M. D.,
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and
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THE literature of deep roentgen therapy is already so voluminous that it would be impossible, in the space of this paper, to enumerate the various men who have conducted experimental work concerning the technic of roentgen therapy upon deep-lying structures. In January, 1914, through the courtesy of Dr. W. D. Coolidge, the writers were given an opportunity to undertake a large series of treatments with the harder rays obtainable by means of the new tube. Extensive experimental work was carried out and a large amount of treatment work, which had formerly been done with water- and water and air-cooled tubes, was continued with the new tube. A number of cases in which, until that time, roentgen therapy had been considered not indicated, were subjected to treatment.

An earlier paper in this symposium, by Dr. G. E. Pfahler,† has detailed a series of experiments which make it unnecessary for us to recount in full the experiments which we carried out, for our experimental observations are in general accord with Dr. Pfahler's results. It may be permitted to state several conclusions which we reached from our own work:—

Using the Coolidge tube and carrying out the experiment with four different makes of transformer and one 24-inch coil of foreign make, it was found that by increasing the parallel spark gap from seven to nine and a half inches it was possible to reduce the time of exposure one half. In other words, the increased penetrating power of the rays secured with the higher parallel gap gave the full dose reading, as measured by the Kienboeck photographic slips, under three millimeters of aluminum in one-half the time required when the tube backed up only seven inches of parallel spark gap between points.

Before the Coolidge tube was available it was rarely possible to maintain a parallel spark gap greater than seven inches for more than a few minutes, using the water-cooled tubes; but with the new tube it is possible to maintain a gap of nine and a half to ten inches for a period which is practically indefinite. The writers have, in one day, with the same Coolidge tube, given an eighteen X dose measured under the filter in each of sixty areas, besides making sixty or seventy roentgenograms of the stomach, using screen plates.

In another series of experiments, in which the measurements were made by Kienboeck strips, carefully wrapped to protect from moisture and warmth, placed in the vagina and rectum in a patient weighing one hundred and fifty pounds, recorded one-twelfth of the reading of the Kienboeck slips placed on the skin but underneath the filter; that is, about one and one-half X for each eighteen X dose (under filter), measured on the skin. In other words, after a series of treatments measuring twenty X units of filtered ray to each of twenty-eight areas in a case of uterine myoma, the vaginal strips registered a total of forty X.

With the gas type of tube, the use of the rhythmeur was conceded to be a decided advantage, but with the Coolidge tube, the writers were unable to discover that it made

* Read at the Fifteenth Annual Meeting of the American Roentgen Ray Society, Cleveland, Ohio, Sept. 9-12, 1914.
† Publsished in the *American Journal of Roentgenology* for March, 1915.

any measurable difference whether the dose was given with the tube under constant excitation or with the current in the tube interrupted rhythmically by a device for this purpose. Accordingly the writers have given up the use of the rhythmeur.

The tendency all along has been to use the hardest possible rays. With the harder rays afforded us by the Coolidge tube, we have been able to shorten the entire time the patient was obliged to remain under treatment, the tangible results appearing very much sooner. Far greater accuracy and resulting uniformity was obtainable in our work, and cures and beneficial results were evident in cases which had heretofore baffled our efforts. Hence at the present time our desire is for tubes which will permit still higher penetration than is afforded by those already at our disposal.

Frequent minor modifications have been made in our work since the technic of deep therapy employing the Coolidge tube was first worked out. The following is essentially the method now employed:

As above stated, our therapeutic work is now conducted exclusively with the Coolidge tube, so regulated that there is a fine brush discharge, with an occasional spark perhaps, between the points of the equivalent spark gap measuring nine and a half inches. With the older types of tube, we were unable to maintain this high resistance in the tube, but in our present work, there has not been the slightest difficulty in maintaining a parallel gap at the point named. The limit of nine and a half or ten inches was set only by the dimensions of the tube thus far furnished. We are informed that tubes with terminals sufficiently far apart to permit a greater parallel spark gap will soon be available for experimental and practical purposes.

It is probable that for ordinary purposes no cooling device at all is needed, but for continuous heavy treatment work it has seemed advantageous to cool the tube by an air blast which, in our office, has been secured by a blast fan such as barbers use for drying the hair. This fan, connected with the ordinary lighting circuit, is mounted on a wooden tube support and so placed that the air blast falls directly upon the tube within its lead glass holder. It may be objected that this plan, which sometimes might cause unequal cooling of the tube wall, might result in cracking the tube, but no such accident has occurred in our work. The shortest distance between the tube and the fan should always exceed seven inches. Or, if preferred, one may enclose the tube in a specially constructed box with special device for air-cooling the tube.

It is frequently stated in the older text books that when using a hard tube, the focus-skin distance should be greater than when using a soft tube. At the present time the tendency is all the other way, viz., to diminish the focus-skin distance to the lowest possible figure. With the therapeutic tube stands now available, the focus skin distance has been reduced to six inches. In some locations it is impossible to bring the tube so close as six inches but under all circumstances it is our endeavor to reduce the focus-skin distance to the minimum.

Understanding that we are speaking of deep therapy, all of our treatments are given through four millimeters of aluminum placed between the tube and the skin, preferably as near the skin as possible, but separated from it by a sheet of leather, the use of which was first advocated by Pfahler.

The time of exposure is variable, depending upon the dosage it is decided to give, upon the focus-skin distance, and upon the degree of penetration of the rays. In our work, employing the Coolidge tube excited by current from an interrupterless transformer (10 K.W. closed core, on 220 volt direct current), we found that with a focus-skin distance of seven inches and the tube of sufficient hardness to back up a nine and one-half inch parallel spark gap between points, irradiation for eighteen milliampere minutes caused the Kienboeck strips under the filtration above mentioned ten X when measured by the Gauss modification of the Kienboeck scale. The law that the intensity of the ray varies inversely with the square

of the focus-skin distance has been found to hold absolutely, so that it has been found possible to construct a table which has enabled us to foretell, with reasonable accuracy, the reading of the Kienboeck strips, taking for granted the use of the Coolidge tube. It should be emphasized that these figures do not necessarily hold good for any other installation, although in our own work with three different types of interrupterless transformer, including both the open- and the closed-core types, the figures are practically the same.

To Produce 10 X *Under Filter of* 4 *mm. Aluminum Plus Sole Leather.*
(*Other conditions as above stated*).

Focus-skin Distance		Milliampere-minutes
7.0	Inches	18
7.5	"	21
8.0	"	24
8.5	"	27
9.0	"	30
9.5	"	33
10.0	"	37
10.5	"	41
11.0	"	45
11.5	"	49
12.0	"	53
13.0	"	62
14.0	"	72

In our earlier work, dosages of filtered ray amounting to from twenty-five to thirty-five X were given, but a larger experience has caused us to reduce the maximum irradiation (except in cases of malignancy) to eighteen or twenty X to each area during twenty-one days. In other words, except when dealing with malignancy no skin area should receive more than eighteen or twenty X units of filtered ray during a three-weeks' period. Nevertheless, by using the cross-fire method, dividing the skin into numerous small areas and directing the ray through each skin area toward the objective point, it is possible to apply in one series a total dosage of 400 to 800 X of filtered ray, depending upon the number of areas available for irradiation. This dosage should not be repeated within twenty-one days; in fact, no more X-ray treatment of any degree should be permitted until the expiration of the three-weeks period. As stated in our preliminary remarks, the rhythmeur is not used.

It is obvious that the employment of the cross-fire method is only indicated in deep-seated lesions. In superficial disease the cross-fire plan is not only useless but it is without reason, and there is danger of omitting narrow strips of superficial tissue which need the irradiation.

The protection of the patient is a topic which demands a special consideration in therapeutic work. In roentgenographic work, the protection of the patient is a matter of minor consideration, no accident of any sort having occurred in our roentgen department in either roentgenographic or roentgenoscopic work. However, in therapeutic work the protection of the patient is of paramount importance, especially on the side toward which the target of the tube points. The anode should always be turned toward the feet of the patient, or better still, away from the body. This may be accomplished by placing the tube obliquely across the body. The tube-holder should be provided with a lead glass bowl, or better still, a closed tube box of the highest possible efficiency, such as is now upon the market for this special purpose. The diaphragm should permit the emission of a pencil of rays only large enough to cover the area to be treated. The various rubber aprons on the market are very variable in their effectiveness and many of them are worse than useless. Each physician should carry out individual experiments to test the efficiency of the aprons upon which he depends for protection. Lead sheets are preferable, being of known efficiency. The writers employ sheets of lead one-sixteenth of an inch in thickness, reënforcing the lead sheets when it seems desirable. The marking of the various skin areas should be done very accurately. Lead aprons or protection sheets should be fastened in place. The exercise of a little ingenuity will result in

simple devices for supporting the weight of the heavy protection.

For the protection of the operator, the tube should always be turned so that the anode points away from the operator's booth. When using the harder rays afforded by the new tube, it is highly desirable to reënforce the lead lining of the booths upon which dependence has heretofore been placed. It is especially important that the lead glass through which the observer watches the patient should be reënforced. The writers use triple thicknesses of the best lead glass obtainable in each of their observation windows.

The hygiene of the X-ray room, as discussed by Alban Koehler and others, should be carefully considered. The ventilation of the operator's booth is especially important. Good ventilation of the treatment room will usually do away with the nausea which the patients sometimes experience.

In a number of cases, particularly cases of carcinoma of the breast, the X-ray treatment has been given through the open wound. Dr. A. L. Gray has reported a case of carcinoma of the bladder treated through an open suprapubic cystotomy wound. One of us has, for years, urged the treatment of breast cases through the open wound at the time of operation and has made special arrangements for accomplishing the work quickly.

It is very important to recognize that no single skin area may receive more than eighteen or twenty X units of filtered ray within a three-weeks' period without danger of over-reaction. We must admit that the degree of tolerance varies with different individuals, but we are satisfied that a dosage of eighteen to twenty X is the limit of safety during a three-weeks' period. Hence in deep therapy unless one deals with an urgent malignancy or takes special steps to desensitize the skin, the treatments should never be repeated in less than twenty-one days. Where a benign process is being treated, the frequency of treatment may be extended to once in four weeks. A tanning of the skin following such vigorous treatments is to be expected, but under any other circumstances, any sign of erythema should at once be recognized as indicating a still longer interval between the treatments.

The patient should be made as comfortable as possible in every way. A soft couch may be substituted for the treatment table. Supports, as by a hoop device, for the heavy covers are very grateful. A pillow under the knees takes away considerable unnecessary strain on the leg flexors. The atmosphere of these rooms is likely to become very close; hence good ventilation should be secured by fans or other devices when necessary. Inasmuch as the patient passes long periods lying flat upon the table, face upward, concealed lights instead of the ordinary glaring open lights afford comfort. The therapeutic room should be made as nearly noiseless as possible. Much bothersome noise may be eliminated by placing the generator in an adjoining room. Some roentgenologists have it so arranged that the generator is in the basement underneath the treatment room. The high frequency discharges soon produce changes in the air which the writers believe is responsible for much of the unpleasant nausea experienced by many of these patients. At any rate, the nausea which frequently follows a series of X-ray treatments is very much diminished and often absent when pains are taken to keep the treatment room thoroughly ventilated. That the nausea is in part due to a degree of acidosis has occurred to us. Experiments are in progress upon this point and a report will be given at a subsequent meeting.

The measurement of the dosage should be carried out with all the accuracy at our command. Prior to the introduction of the Coolidge tube, the writers depended upon the Kienboeck or the Sabouraud scale and measured almost every treatment. Since the introduction of the Coolidge tube, providing one has a source of high potential which is sufficiently constant, the measurement of the dosage by means of the parallel spark gap, the focus skin distance and the

Photograph showing tanning of the posterior areas as the result of the radiation through filters in the course of deep therapy for a pelvic malignancy.

time in milliampere minutes, is satisfactory. We prefer the Kienboeck scale to the Sabouraud for various reasons, principally that the use of the Kienboeck strips gives permanent evidence of the dose administered, providing the reading has been correctly taken. At the present time the writers frequently expose a Kienboeck strip more as a matter of a check upon the technic of the treatment than for actual measurement.

The accompanying photograph shows the tanning in a number of skin areas in a case treated for uterine fibroids. It will be noted that the discoloration of the skin is uniform, indicating that very nearly the same dosage of X-ray was applied to each of the areas. Thanks to the Coolidge tube it is possible to produce the same effect in area after area, provided one records the parallel spark gap, the focus skin distance, and the milliampere minutes.

A number of cautions are necessary regarding the reading of the Kienboeck photo strips. It is important to avoid exposure of the photographic slips to heat. Most important of all the temperature of the developer in which the photoslips are developed out should be kept accurately at 60°F. The Kienboeck method is probably the most reliable of all the photometric means of measuring the dosage, yet it is, on the whole, unsatisfactory because of a certain degree of inaccuracy which is necessarily involved in any photographic process; still it serves very well for comparison of results, especially for one's own work. In order to avoid the influence of the secondary rays, generated in the aluminum filter, upon the photoslip, the writers have, as a routine, slipped the Kienboeck strips into a leather holder before placing them underneath the aluminum filter.

If one applies a dosage of only ten or twelve X to each skin area, there will probably be no visible effect on the skin until after several series. If the limit of skin tolerance is approached, however, as when a limit dose of 20 X is given, there will appear within a few weeks a ruddy bronzing of the skin, as shown in the accompanying photograph. This tanning lasts for months, but finally fades away.

THE SAFE INTERPRETATION OF ROENTGENOGRAMS OF THE GALL BLADDER REGION

By E. W. CALDWELL, M. D., New York

DURING the last ten or fifteen years there have been several periods of revival of interest in the roentgen diagnosis of gall stones. Nearly fifteen years ago a well-known surgeon demonstrated at the New York Academy of Medicine a number of plates showing spots alleged to be due to gall stones in patients who were proven by operation to have had gall stones. These gall stone plates showed a few spots which were obviously due to carelessness in development and the rest were other artifacts. In these cases the diagnosis was correct, but the supposed confirmatory evidence of the X-ray plates was absolutely useless, because it might have been found just as easily in X-ray plates of normal subjects.

During the last two or three years a number of able and well-known roentgenologists have claimed an astonishingly high percentage of success in the roentgen diagnosis of gall stones. I do not wish to question the accuracy of the reports of the cases presented by these men but I am inclined to think that it is unsafe to draw general conclusions from them.

For many years we have known that gall stones containing a sufficient quantity of mineral salts could be demonstrated definitely and positively by X-ray plates. From our results in X-ray examination of patients who have proven by operation to have had gall stones; and from experiments with fresh gall stones that have been removed from the body, we long ago came to the conclusion that a large proportion of such stones differed so little from the surrounding tissues in their opacity to X-ray that we could not hope to obtain X-ray shadows of them. On a foggy day we do not see the shadow of the clouds, however brilliantly the sun may be shining above. For similar reasons, we do not obtain X-ray shadows of gall stones when their opacity to the X-rays, now at our command, is the same as that of the surrounding tissues.

It is difficult to estimate the proportion of gall stones that come in this class. Probably a great many—perhaps nearly all—may produce discernible shadows on the X-ray plates, but we must remember that irregularities in the normal viscera and the intestinal contents, as well as irregularities in the manufacture, developing, fixing, washing, and drying of the plates, also give rise to areas of varying density which may resemble faint shadows of stones. By making a large number of plates and by using the utmost refinements of technique, our chances of seeing shadows of gall stones are improved, but such procedures also bring out better some of the other shadows just mentioned.

If only we make enough plates and make them well enough, we can obtain suspicious shadows in the gall bladder region of any normal individual. The interpretation of gall stone plates, therefore, becomes a matter involving not only skill and judgment, but temperament as well. In no other field of roentgen diagnosis is the personal equation of the observer more important.

This, I believe, is the best explanation of why some observers report as high as 85 per cent. and others as low as 5 per cent. of successes in these examinations. I am convinced that the difference cannot be accounted for by differences in technique. Some of the most optimistic observers have

been conspicuous for lack of skill in making plates.

The X-ray, like many other useful things, is capable of harm as well as good. The dangers of the X-ray are due chiefly to those who use it, and these dangerous persons may be classified in about two groups.

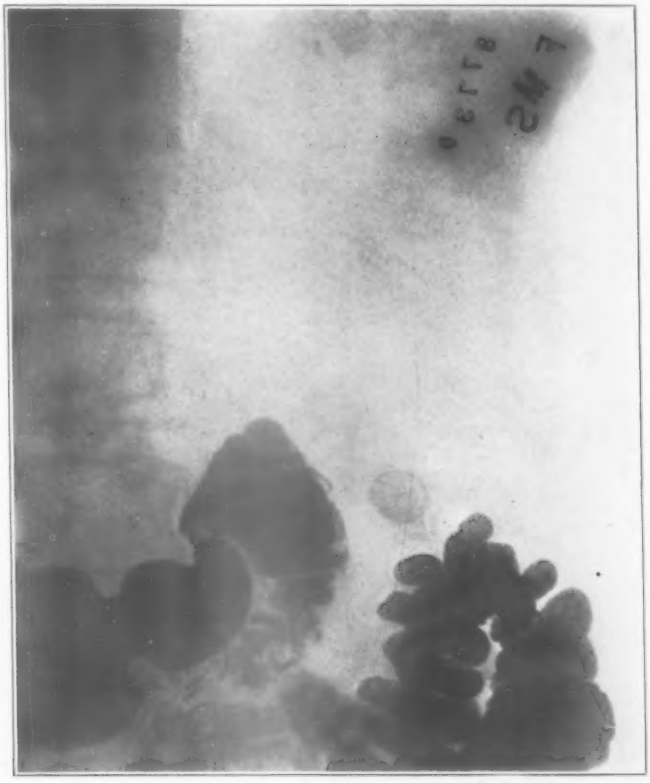

Fig. 1—Circular gallstone shadow near bismuth shadow of duodenum.

In the first group we naturally place those men of medical training who are devoting all of their time to the use of X-rays; who call themselves roentgenologists, and who think they know more about the subject than anyone else. In the second group are the physicians and surgeons who make use of the rays either directly or by proxy in the course of their clinical work. They also are firmly convinced that they know more about the subject than anyone else.

The greatest danger of the X-ray is in the faulty interpretation. These faults of interpretation usually consist in reading into the plates something which is not there. Much suffering may result from faulty interpretation of X-ray plates of any part of the body, but the especially dangerous zone is in the upper right quadrant. It is in this danger zone that the number of killed and wounded resulting from faulty interpretation is greatest. Although the X-ray gives much valuable information concerning the region of the gall bladder, the pylorus, and the duodenum, this is the region concerning which reports are most conflicting and where safety demands the most rigid censorship.

Roentgenologists as well as surgeons are prone to draw conclusions, which, although derived from faulty observations of X-ray plates, may often be proven by operation to be true. A well-known surgeon in this city found a shadow in an X-ray plate of a head which he pronounced to be due to a brain

tumor. He operated and found a tumor which seemed to correspond in size and shape with the spot in the X-ray plate. After this surgeon had been shown similar tumor shadows in plates of a number of other heads he was finally convinced that the petrous portion of the temporal bone was responsible for the alleged tumor shadow. A less fortunate surgeon once operated to recover a set of false teeth, the shadow of which he thought he saw in an X-ray plate of the stomach of a patient. Operation failed to disclose the teeth, but the patient did not survive long enough to learn that he had left his teeth under his pillow instead of swallowing them as he supposed and as the X-ray apparently proved.

I could tell many stories of mistakes of roentgenologists but they have already been given the freest and widest publicity, while the roentgenological mistakes of the surgeon do not always appear in the official bulletins from the front.

The clinical indications of gall stones are fairly accurate and it is likely that stones are present in at least fifty or sixty per cent. of those cases submitted to X-ray examination. On these perhaps as many as one-tenth give perfectly definite reliable X-ray shadows of gall stones. In the other nine-tenths of the cases examined, some of the X-ray plates will show hazy and suspicious shadows many of which are due to gall stones. If we consider all of these hazy and suspicious shadows corroborative evidence of gall stones, the operation will vindicate us in the majority of the cases, and we may easily over-estimate the help actually obtained from the X-ray plates. It is easy even for an experienced observer, how-

Fig. 2—A wire shows the location of right costal margin. A group of gallstones is shown below it.

ever honest he may be, to fall into this error. For this reason we must be very careful lest the clinical knowledge we have of the patient may lead us to accept as evidence of gall stones X-ray shadows such as might be found in some of the X-ray plates of any normal individual.

For the safe interpretation of X-ray plates of the gall bladder region we must avoid this error by refusing to permit the clinical record to lead us to accept as evidence of gall stones any X-ray shadow that does not present characteristics distinguishing it definitely from other shadows and which has not the sharpness of outline commonly found in the shadows of other calculi.

This is really all I intended to say about the subject but I must emphatically disclaim any intention to discourage the use of X-ray examination for gall stones. Definite and reasonably safe indications of the stones will often be found in X-ray plates.

I think that the absence of gall stones cannot, at the present time, be demonstrated with a reasonable degree of safety.

It is quite certain that with the many useful tricks of technique which are now well known, we can demonstrate a larger percentage of gall stones than was possible a few years ago. In this connection I may mention that it is desirable to make a large number of plates with different angles of incident rays, at different stages of the respiratory circle, and with rays of different degrees of penetration.

The use of a diaphragm is indispensable and compression is often useful. Compression with a cylindrical tube carrying a small film that can be crowded deeply into the abdomen, as advocated by Selby and others, may be useful.

Filling the colon with air or gas to obtain a gall bladder shadow over the gas is occasionally successful.

Short exposures with powerful apparatus are best. Stereoscopic plates are often indispensable. Direct fluoroscopic examination with palpation under the screen often gives information that cannot be obtained with plates. By this method the mobility of the pylorus and duodenum can be investigated, tender spots can be located definitely with reference to the bismuth-filled duodenum, deformities in outline and position of the duodenum due to gall bladder adhesions can be shown better on plates and fluorescent screen.

It is important to have the best possible arrangements for illuminating X-ray plates when they are examined. A mercury arc such as the Cooper Hewitt lamp gives excellent illumination and a good North light is also good. Both enlarging and reducing lenses may be used with advantage in studying plates. A reflecting prism stereoscope is a convenient and valuable accessory.

Future developments of technique will doubtless greatly increase the value of the X-ray in this field. A practical development of Bucky's method of suppressing secondary rays is by far the most promising thing in sight. We shall probably be able some day to use characteristic X-rays of uniform wave lengths with much better results than we now obtain with the heterogeneous mixtures of rays which we have available. Even in the present very imperfect state of development of roentgen appliances and technique, it is possible to obtain X-ray shadows giving much useful information concerning the gall bladder region.

It is very easy to make a roentgen diagnosis of gall stones. The difficult thing, just now, is to avoid making such a diagnosis occasionally, when no stones are present.

THE RÔLE OF THE ROENTGEN RAY IN THE DIAGNOSIS OF THE OBSCURER FORMS OF HEART DISEASE *

By H. WESSLER, M. D.,
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I SHALL leave out of this discussion the roentgen appearance of the heart in the ordinary valvular lesions, which can only supplement or verify the results of clinical examination. It need only be pointed out that the heart shadow in these conditions is a typical one and is frequently by itself diagnostic. The clinician, however, does not have to be told the particular valvular lesion with which the patient is affected; such information from the roentgenologist is apt to be viewed only with good-natured tolerance. It may nevertheless be stated that even here it is often possible to disclose the presence of valvular lesions concerning whose existence the clinician may be in doubt. Thus the roentgen ray shows the great infrequency of pure mitral stenosis, which in the absence of a murmur of insufficiency is often diagnosed. The Flint murmur offers no difficult problem in differential diagnosis if the fluoroscope can be brought to one's aid. A presystolic murmur, if due to an aortic insufficiency, would be associated with the cardiac contour of aortic disease, which at a glance can be differentiated from that of mitral stenosis. Similarly the pseudo-stenotic murmur which is heard in hypertrophied hearts will readily have its origin assigned to it by roentgen examination.

There is, however, a large field of cardiac abnormality, in which the roentgenologist, aided by a clinical knowledge of the case and the ability to correlate the clinical findings with his own proper data, can throw light on the case which is obtainable by no other means, or can be arrived at only inferentially. I may say here that there is perhaps no department of roentgenology in which clinical knowledge is so essential as in that which is devoted to the study of the heart.

In the first place I would ask your attention to that great group of cardiac cases which may be described as functional, at least in the clinical, if not in the anatomic, sense; that is, cases in which there are subjective symptoms but in which physical examination shows few or no changes in the heart. It is evident that here is a fruitful field for the activities of the roentgenologist because he can unearth changes in morphology which cannot be determined by other means.

The Drop Heart

By a drop heart is meant one which appears to be suspended centrally in the chest from rather elongated vessels, resting with its apex on the diaphragm. It is narrow and by actual measurement much below the normal in width (Fig. 1). Every roentgenologist knows how frequently such hearts are encountered in cases of pulmonary tuberculosis and in visceroptosis. In these conditions it is apparently a part of the general asthenic or atonic habitus and does not usually project itself prominently into the clinical picture. It could aptly be termed the asthenic heart. In emphysema

FIG. 1. Drop heart.

* Read before the N. Y. Roentgen Society, January, 1915.

and asthma it is also common; here it probably owes its origin to other factors.

It is, however, at the time of puberty that the drop heart acquires its greatest importance, since it manifests itself by a group of symptoms which Kraus has aptly described as those of a constitutionally weak heart.

The pediatrist will often see these children who complain of heart symptoms which may be the cause of considerable anxiety. This anxiety may gain confirmation by clinical examination which may show marked overaction, apparent enlargement to the left and variable murmurs. Under these conditions a diagnosis of organic heart disease is apt to be made.

Fluoroscopic examination will at once set things right. These hearts are hypoplastic, not enlarged, and the murmurs are evidently functional. It is a fact that the size of these hearts cannot easily be determined because of their overaction and the so-called irradiation of the apical impulse which lead to error. It is therefore permissible to reassure the parents; they can be told that the heart weakness is a relative one only, that it is probably due to a disproportion between the growth of the child and the ability of the heart to keep up with such growth. It should be emphasized that these drop hearts are functionally inferior, for which there is probably a permanent basis in their small size, but that this inferiority manifests itself only at a period of stress as will happen at puberty.

Unlike organic heart lesions, these children would be best treated by an outdoor life with exercise so as to favor a proper development of the cardiac muscle. It is evident that the roentgen ray may play an important rôle in directing prognosis and treatment into the proper channels.

Functional Murmurs

Functional heart murmurs are of fairly frequent occurrence in children beyond the age of five years and are casually found in adults who are apparently otherwise well and show no other evidence of heart disease. The finding of such a murmur usually raises the suspicion of a latent valvular lesion and is the cause of considerable disquietude.

Now it may be stated in a general way that organic murmurs, resulting as they do, from diseased valves, are associated with changes in the size and shape of the heart. The roentgen ray is eminently designed to disclose changes in heart size and shape. If, therefore, in a case in which murmurs of doubtful significance are heard, the heart shadow has none of the earmarks of a valvular lesion, we may assume, provided a congenital lesion can be excluded, that the murmur is of functional origin. Similarly in many cases of anæmia we find murmurs, often quite loud, without any change in the configuration of the heart. It is only in very severe anæmias that the heart and especially the large vessels (over which the murmurs are heard) are enlarged.

Angina Pectoris and Anginoid Pains

We come now to a group of cases in which cardiac pain plays such an important part that it dominates the entire clinical picture. I refer to cases characterized by substernal pain which may vary in intensity from the milder anginoid to true angina pectoris. It is not possible to exaggerate the frequency of these conditions nor their seriousness. Unfortunately for the purposes of accurate diagnosis these pains do not result from a single pathologic process in the heart. They may either be the expression of a slight degeneration or inflammation of the beginning of the aorta or they may indicate a narrowing of the coronaries at their orifices or in their course with a fatal infarction of the heart muscle. What light can the roentgenologist throw on the various conditions underlying these pains?

(1) In some cases, even in children, we find evidences of an ordinary valvular lesion with a much enlarged heart. The mechanism of the production of the pain in these patients is perhaps the compression of the enlarged heart and its coronary vessels by

FIG. 2. Chronic nephritis—hypertension-atheroma of the aorta with dilatation of its arch and descending portion.

the rigid chest. Such pains are encountered even in patients with hearts of normal size but with abnormally small chests, especially if they are engaged in sedentary occupations in which the chest expansion is limited, as pointed out by Hertz.

(2) In another group of cases we see evidences of atheroma of the aorta frequently associated with chronic nephritis and arterial hypertension (Fig. 2). Fluoroscopy discloses the large hypertrophic heart with a diffuse dilatation of the aorta which may throw an intense shadow due to sclerosis and lime deposits. In this group of cases in distinction to those later to be described, the arch of the aorta and its descending portion are apt to be more dilated than its origin.

(3) Thus far we have been dealing with cases in which the clinician alone will have no difficulty in arriving at a just estimate of the case. We come now to the remaining cause of angina in which usually, from the ordinary examination of the heart, the examiner will derive very little information and he will be dependent to a great measure on the patient's symptoms. The reason for this is that the trouble lies not so much in the heart as in the aorta and the latter, unless it is much diseased, gives rise to but few physical signs. I refer to cases of aortitis, usually of syphilitic origin, together with the associated coronary arteritis, with which, by the aid of the Wassermann reaction and the roentgen ray we are becoming more and more familiarized. By means of the latter we become aware of slight changes in the caliber of the aorta which entirely elude clinical examination.

As far as the roentgen ray is concerned the aorta is subject to two kinds of changes —alterations in density of its shadow and changes in contour. Thus we are all familiar with the dark, sometimes irregular aorta of atheroma with the prominent arch projecting into the left lung field. With this we are not now concerned. In early cases of aortitis the changes are not so pronounced. The pathological process is usually localized to the very origin of the aorta. The aorta is not thickened nor are there lime deposits. On the contrary, it is thin and the resulting shadow is a faint one. We see therefore usually a slight dilatation of the first part of the aorta with an exaggerated pulsation.

I have had occasion to examine a considerable number of patients with angina and have found this slight dilatation of the ascending aorta a very frequent phenomenon. Now it should be conceded that a slight dilatation of the aorta is not an uncommon finding. It is a practically constant finding in ordinary sclerosis of the aorta; in this condition, however, it is nearly always accompanied by a prominence of the arch and frequently by a hypertrophy of the left ventricle. In cases of aortitis with or without coronary disease, however, the heart is rarely enlarged or hypertrophied unless there is a co-existing hypertension. So that it has frequently been a surprise to find in a case of severe angina pectoris, in which one is led to infer the existence of a weak and dilated heart, that the latter is normal in size. The orthodiagram which I here show you (Fig. 3) is from a patient who had a true alternating pulse and died of a cardiac infarction a short time later. You will note the dilatation of the beginning of the aorta with a heart of normal size.

Of course, the lesions of syphilitic aortitis and of athero-sclerosis can be combined in the same heart. This is illustrated by Figure 4. Here we have a luetic patient with chronic nephritis and a much enlarged heart. In addition to a marked diffuse dilatation of the aorta, its first portion, as a result of the aortitis, has reached the size almost of an aneurysm. Some cases will undoubtedly present difficulties in diagnosis, in the elucidation of which there will be room for the exercise of nice clinical judgment.

Coronary disease itself we are unable to diagnose directly. We know, however, that disease of the coronary arteries frequently develops by extension from the root of the aorta. The contour changes in the aorta in aortitis, may therefore be taken as evidence of changes in the coronaries. Unfortunately, we will be unable to say whether we are dealing with a mild aortitis, which, aside from some pain, will not inconvenience the patient or whether he is afflicted with a fatal myocarditis. The decision of this question rests with clinical medicine.

The subject of aortitis is closely related to that of aneurysm as would be expected, as the basic lesion, a mesaortitis, is the same in both. A reference to Figure 4 will make it evident how a gradual transition to a sac-

FIG. 3. Angina pectoris—coronary disease. Slight dilatation of first part of aorta without sclerosis. Heart is not enlarged.

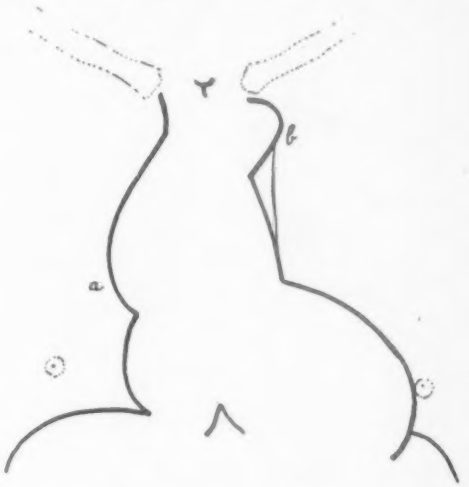

FIG. 4. Shows dilatation of origin of aorta (*a*), due to specific aortitis and atheroma of arch and descending aorta (*b*). Heart much enlarged.

culated form of dilatation may occur. Of course, this does not necessarily explain the mechanism of the development of all aneurysms.

THE HEART IN NEPHRITIS AND HYPERTENSION

As is well known, in many cases of chronic nephritis, especially vascular nephritis, the cardio-vascular symptoms are more prominent than those of the nephritis itself. In practically all cases of nephritis with hypertension, the heart has a distinctive appearance which is due to a marked hypertrophy of the left ventricle. It will reveal a contour of the type shown in Figure 5. You will note that the heart has the so-called egg shape and the left ventricle exhibits a very active pulsation. Its size depends on the muscular efficiency of the left ventricle. If the latter is efficient, the heart is normal in size. When it fails there results a dilatation to the left. There is, however, a more significant change in contour which results from a marked insufficiency of the cardiac musculature. This consists in an enlargement of the left auricle and the pulmonary artery, as an evidence of backflow due to muscular insufficiency of the mitral valves (Fig. 6). Such an appearance in a nephritic

FIG. 5. Hypertrophy of the left ventricle in nephritis of a child. No dilatation; heart is compensated.

heart has perhaps some value for prognosis. I have had occasion to study the hearts of children who had nephritis of a mild form months or years after scarlet fever, and although the physical signs of hypertrophy were very slight, by means of the orthodiagram a heart of the type illustrated in Figure 5 could frequently be demonstrated. The discovery of such a heart fluoroscopically may permit the inference of a latent or underlying nephritis.

DILATATION OF THE AORTA

The diagnosis of aneurysm of the aorta is made clinically much more frequently than is warranted by the roentgen findings. This is due to the frequent presence of murmurs over the aorta and the palpation of a pulsating mass in the episternal notch. When we fluoroscope these patients we often find the appearance shown in Figure 2. Here we are dealing with a dilatation of the aorta which is atheromatous, not aneurysmal. Note that the heart is dilated and hypertrophied. One of the most important facts in the diagnosis of aneurysm is that the heart is neither hypertrophied nor dilated unless there is a complicating nephritis or a valvular insufficiency. Unfortunately, such fluoroscopic findings are often made the basis of a diagnosis of aneurysm by those possessing insufficient clinical knowledge.

A dilated aorta is a constant finding in cases of aortic insufficiency. This valvular lesion, as is well known, is due either to rheumatism or is secondary to a syphilitic aortitis. In the latter case we usually find a considerably greater dilatation of the aorta than in the former and this may be used as a means of differentiating the two conditions (Fig. 7).

CARDIAC DISPLACEMENT

As is well known, the heart readily alters its position in response to changed space conditions in the chest. Roentgenologic study of the chest, however, has shown that change in the position of the heart follows no very definite rules. It is surprising to find, for example, large accumulations of fluid or air in the chest with little or no change in the position of the heart.

There is, however, one condition of much rarity in which the heart suffers an extreme displacement, so extreme in fact that a condition of situs inversus has been assumed to exist. I refer to eventration of the diaphragm, an example of which is illustrated in Figure 8. The left leaf of the diaphragm

FIG. 6. Beginning failure of the left ventricle in nephritis of child. Note enlargement of pulmonary artery (*p*) and auricle (*a*).

is relaxed and displaced upward by the underlying viscera so that the heart appears in the right chest. Such a case is instructive and would render advisable the roentgenographic examination of every assumed case of dextro-cardia.

Congenital Heart Disease

The diagnosis of congenital heart lesions has more a theoretic than a practical interest. As is well known, the determination of the particular abnormality which is present is a matter of inference which never attains more than a certain degree of probability. None the less in selected cases roentgen examination is capable of supplying data which may profitably be marshaled with the other clinical facts for purposes of diagnosis. It may therefore be desirable to indicate briefly from a clinical and roentgenological standpoint a few suggestive groupings.

Fig. 7. Luetic aortic insufficiency showing dilatation of aorta, especially its first part.

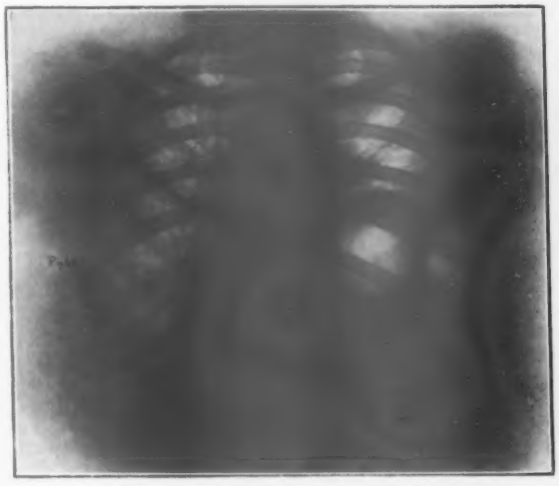

Fig. 8. Eventration of diaphragm. Heart displaced entirely into right chest by high left diaphragm.

(1) One class of patients is seen in whom we find little or no evidence of circulatory trouble, that is, no dyspnœa, cyanosis or marked subjective symptoms. Examination of the heart discloses usually a rough murmur over the pulmonic area, which is either systolic or lasts throughout the cardiac cycle, together with a much accentuated pulmonic sound. This murmur has in addition certain areas of distribution in the chest. These are often cases of open Ductus Botalli and will show on fluoroscopy a figure of the type seen in Figure 9. Its outstanding feature is a large pulsating pulmonary artery which is responsible for the area of dullness along the left border of the sternum known as Gerhardt's sign. The heart is usually normal in other respects. It lacks the characteristic shape seen in mitral disease in which also the pulmonary artery attains a considerable size. It is necessary to emphasize that the diagnosis of this condition rests on the observation of an abnormally wide pulsation of the artery and must therefore depend primarily on fluoroscopic examination. The only condition with which it could readily be confused is aneurysm or atheroma of the pulmonary artery; this would be avoided by a study of the clinical history and the other available data.

(2) In the next group of cases, murmurs are heard in the chest whose origin it is difficult to explain. Either their occurrence at a very early age or their atypical distribution and an absence of a cause of endocar-

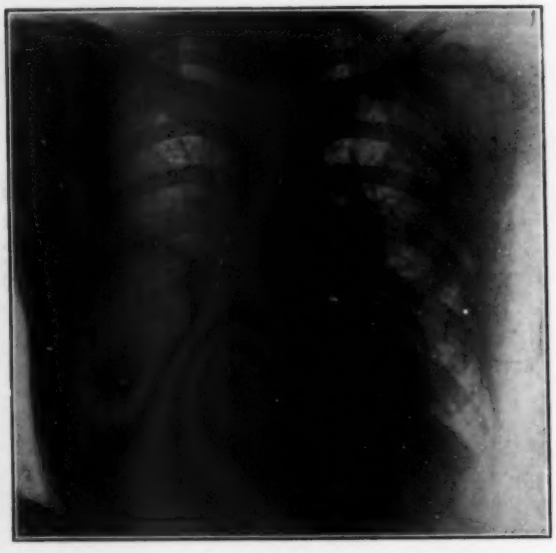

FIG. 9. Open ductus Botalli. Arrow indicates the large pulmonary artery which shows an exaggerated pulsation on fluoroscopic examination.

ditis make it improbable that they are acquired. In these individuals we often see a heart shadow normal in every respect. In the absence of cyanosis or other circulatory changes in the body, we must infer some minor abnormality such as an open foramen ovale or septum.

(3) The third group comprises the cases with cyanosis and other evidences of abnormal blood distribution, associated often with pulmonary tuberculosis. We find in these patients, whose basic lesion is a pulmonic stenosis, a varying fluoroscopic appearance. There is, as a rule, evidence of hypertrophy of the right ventricle, but owing to the position of the latter in relation to the heart borders, the transverse diameter of the heart is not increased. In some of them because of an unequal development of the arterial conus, the aorta is wider than normal. Many interesting combinations are seen and one has ample field for the exercise of ingenuity in the analysis of both the clinical picture and the orthodiagram, so that they may supplement each other. The possibilities of such an analysis are exhibited in a case of which Figure 10 is the orthodiagram. This patient, a girl of fifteen years, is slightly cyanosed, gets attacks of faintness and palpitation and has signs of pulmonary tuberculosis. There is a rough systolic murmur over the pulmonic orifice and an absence of the second pulmonic sound. The sounds are otherwise normal and the heart does not appear to be enlarged. Clinically, one would here diagnose a stenosis of the pulmonary artery. The orthodiagram, however, throws much additional light on the case. The heart is exquisitely rounded or ball shaped, an indication of marked hypertrophy of the right ventricle. The actual width of the heart is 11.9 cm., which is practically normal. The shadow of the pulmonary artery is not seen, but the aorta is apparently normal in size and position. When the contraction of the heart is studied a remarkably wide pulsation, about one inch in amplitude, is noted at the right border of the heart. This pulsation is ventricular in time and must therefore be produced by right ventricle. Now, the ventricle does not normally reach the right border of the heart—there must therefore have occurred a marked dilatation of the right ventricle without a coincident enlargement of the right auricle. Denecke has shown that such an enlargement with its associated pulsation is due to a consider-

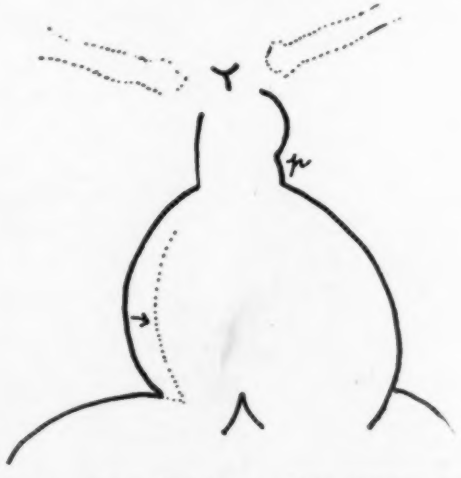

FIG. 10. Congenital heart. Note globular shape—poorly developed pulmonary artery (*p*). Dotted line indicates excursion of the right border of heart, synchronously with the left, due to open septum ventriculorum.

able patency of the ventricular septum. Combining therefore the results of the clinical and roentgenological examination, it is suggested that the lesion we are dealing with is a stenosis and maldevelopment of the pulmonary artery (note the absent pulmonic sound), a widely open septum and possibly a faulty implantation of the aorta.

Pericarditis

The roentgen ray is not of much service in the diagnosis of pericardial effusion in its early stage. When, however, the pericardial sack is distended with fluid, the heart acquires the distinctive form seen in Figure 11. It will be noted that there is no obliteration of the cardio-hepatic angle as is found on clinical examination. On the contrary, the angle is accentuated and helps to distinguish a pericardial effusion from a dilatation. The heart shadow is also increased in extent upward so that it encroaches on the great vessels. Not infrequently, the fluid does not distend the pericardium uniformly, but may cause a localized prominence, for example, in the left axilla.

The cardiac pulsations are not necessarily absent, but may be transmitted by the surrounding fluid. On the other hand, large dilated hearts, without effusion frequently show no pulsation at all.

The diagnosis of adherent pericardium is a matter of some uncertainty. Undoubtedly, some cases of extreme dilatation of the heart, especially to the right, are associated with an adherent pericardium, but in such cases the silhouette differs in no wise from that found in the ordinary valvular lesions. The pericardial changes usually seen result from a pericarditis externa with a resulting agglutination of the parietal pericardium with the surrounding structures, the mediastinum and pleura. Such adhesions are readily seen on fluoroscopy, especially on deep inspiration, and often accompany other evidences of pulmonary tuberculosis. A characteristic fluoroscopic picture is apt to be seen only if both leaves of the pericardium are firmly attached to the diaphragmatic pleura. An example of such a combination is seen in Figure 12. This patient has a tuberculous pleuro-pericarditis with adhesions. The heart is drawn over to the left and numerous connective tissue bands run from the pericardium to the pleura. With each systole of the heart, especially on deep inspiration, the left diaphragm is pulled bodily upward and the apex is displaced to the left. On the clinical side, corresponding to this, there is a well marked Broadbent sign.

The very rare condition in which there is an accumulation of air in the pericardium can only be positively diagnosed by the

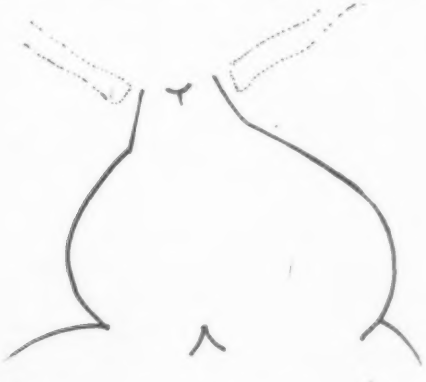

Fig. 11. Large pericardial effusion. Note obliteration of cardiac contours and the persistence of the cardio-hepatic angle.

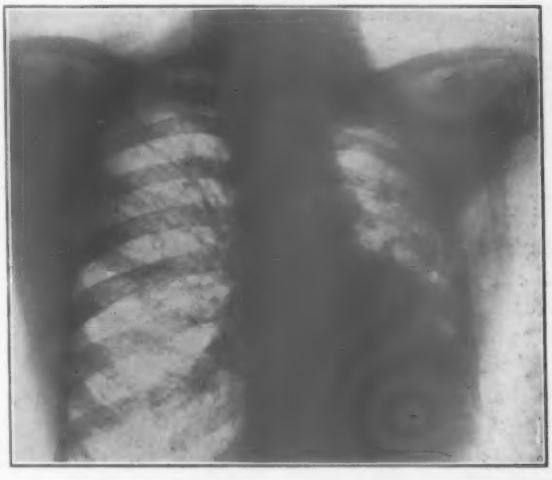

Fig. 12. Adherent pericardium—mediastino-pleuro-pericarditis. Heart pulled into left chest by adhesions. Broadbent sign.

FIG. 13. Pneumopericardium—shows pericardium filled with air. Patient lying on left side. Fluid and air in left chest.

roentgen ray (Fig. 13). It is due in this case to communication of the pericardium with a tuberculous pneumothorax. It is characterized by a curved linear shadow of the pericardium which is raised off the heart by the underlying air. Owing to mechanical conditions the air may occupy only one-half of the pericardial cavity, as in the case illustrated.

PULSATION PHENOMENA

Inasmuch as the heart is an organ in movement, some emphasis must be placed on its various pulsation phenomena. With respect to the vigor of its contraction, we distinguish in general two types of pulsation, the so-called strong and the feeble type. The greatest overaction, as evidenced by the amplitude of the contraction, is found in cases of aortic insufficiency and exophthalmic goitre. In the drop heart and in the juvenile heart we also see marked pulsations. The heart of hypertension in its compensated stage usually shows a wide, slow, deliberate pulsation. When this heart becomes dilated, it is surprising to note the almost complete absence of pulsation. A diminished movement of the left border is seen in the various valvular lesions when the heart is much enlarged and also in coronary disease with much degeneration of the cardiac musculature. One must, however, be cautious in drawing inferences as to the contractile power of the heart from the vigor of its movements seen with the fluoroscope as the latter does not bear any definite or necessary relation to the former.

The pulsation of the right border of the heart, that is, of the right auricle, is of considerable interest. Normally it is of small amplitude and scarcely visible. Under various pathological conditions however it may become much exaggerated. Thus, it partakes of the overaction in the rest of the heart in hyperthyroidism. In cases of tricuspid insufficiency a marked systolic distention of the auricle can be seen, varying in degree with the grade of insufficiency. From the results of Roentgen examination tricuspid insufficiency is much more common than clinical examination would lead us to suppose and is not necessarily indicative of extreme decompensation.

In large mitral hearts one sometimes encounters an unusual appearance of the right border, it being composed of two separate curves (Fig. 14). The upper one is due to the right auricle, the lower darker one, to the right ventricle which has enlarged to the right displacing the auricle upward and back. The identity of these curves can easily be verified by their pulsation phase.

It was previously mentioned that in cases of open septum, the right border may exhibit a wide systolic pulsation. I have observed a similar phenomenon in a case of complete heart block, due apparently to a great increase in the size of the right ventricle. In this case three distinct impulses were visible in both ventricles during their diastolic distention with blood, followed by a large systolic contraction.

In auricular fibrillation one would not expect to see any movement of the right border inasmuch as the auricle is not contracting, at least coördinately. Nevertheless, in an examination of a considerable

number of these cases I have uniformly found a movement of the right border of the heart, auricular in time. Not only was a movement observed but this was usually greater than is normal. Inasmuch as the auricle, as proved by the electrocardiograph, is not actively contracting, the significance of this phenomenon cannot easily be explained. I have thought that it might be due to a relative tricuspid insufficiency.

Before leaving this subject, a few words concerning the pulsation of aneurysms may not be amiss. Pulsation in aneurysms plays a minor rôle in their diagnosis by the roentgen ray. Marked pulsation of the aorta is in fact a less characteristic sign of aneurysm than of other forms of aortic dilatation such as those occurring in aortic insufficiency and athero-sclerosis. This is due in the first place to the great thickening of the wall of the aorta by lamellated clot which fails to transmit the pulsation and also to a loss of elasticity which is an essential element in luetic disease of the aorta. Further, as the heart is not usually increased in size, the systolic distention of the artery need not be greater than normally. It is probably in the cases in which aneurysm of the aorta is complicated by a valvular insufficiency, a fairly frequent occurrence, that the marked expansile pulsation is seen. Thus it is very pronounced in the cases of luetic aortitis in which the aortic dilatation has not reached a size which would warrant calling it an aneurysm.

In conclusion, I would make a few observations on the rôle of the Roentgen ray in the determination of the functional capacity of the heart. It was hoped, when the roentgen ray was first applied to the study of the heart, that it would throw some light on the condition of the heart muscle by disclosing changes in its size in response to exercise or inter-relations of heart size and blood pressure. Unfortunately, all such efforts were without results. Fluoroscopically hearts in the stage of compensation may differ no wise from their appearance when decompensated. One patient with a very large heart may be much less decompensated than another with a smaller heart, although both may be suffering from the same valvular lesion. In short, the Roentgen examination teaches us very little concerning the relative tone of the cardiac muscle.

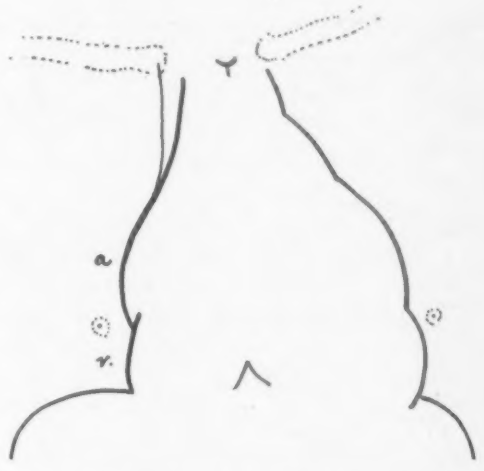

FIG. 14. Decompensated mitral disease. Right border shows 2 curves, auricular (*a*) and ventricular (*v*), due to marked dilatation of right ventricle.

Inferences drawn from the pulsation of the left ventricle are misleading because when the heart becomes very large and hypertrophic the pulsation is apt to disappear without any evident coincident change in the symptoms. I have seen the pulsation of the left border which was entirely absent during moderate decompensation, become very pronounced when the symptoms were aggravated and the patient showed signs of grave circulatory failure. This apparent paradox was due to an additional dilatation of the right ventricle so that it extended to the left border of the heart, where its contraction, previously invisible, could now be seen. Nor do we usually see a marked decrease in the size of the heart after the administration of digitalis with improvement of the symptoms. When such a decrease in size is noted it must always be questioned, as Dietlen has suggested, whether it has not resulted from the resorption of a pericardial effusion.

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NOTES ON THE DIAGNOSIS OF STOMACH CONDITIONS BY THE ROENTGEN RAY *

By H. W. VAN ALLEN, M. D., Springfield, Mass.

IT has been some years since physicians and surgeons were satisfied with anything less than an accurate diagnosis upon the conditions obtaining in digestive disturbances; and now even the public have become dissatisfied with being told simply that they have indigestion, dyspepsia or gastritis. An accurate knowledge is demanded, and out of this demand has grown our ability to tell stomach conditions with great precision.

Two methods of examination have been developed; both with great nicety, both with relative merit, both failing in some and excelling in other points of accuracy in diagnosis. I refer to the roentgen method and to the stomach content analysis. This latter has been so efficiently spoken of by my able colleague, Dr. Cort, that anything I could say would be puerile, so I will only speak of stomach analysis in a comparative way with the roentgen diagnosis.

I might place myself on record, however, by saying I do not believe any examination of the stomach is complete without both methods being employed. The relative value is, however, a thing that can be freely discussed and never probably settled. Because someone would say my judgment was biased as a specialist, I would not dare put this relative value as high as Scudder of Boston has when he says the roentgen examination plus the clinical history is 90 per cent. of the total examination. This probably from a surgeon of such repute is, however, not far from right.

Another way to ascertain the position of the roentgenological study of the stomach is for each of you to ask himself, as thinking and capable physicians: Were a capital operation on the stomach contemplated personally, would any of you neglect the diagnostic value of the X-ray? I think not. Why not do as much for your patients?

I would not have you understand that the roentgen method does not make errors. The fault, however, is almost entirely in the technique, or more often in the lack of study of the plate, or inexperience of the one making the interpretation. In other words, the evidence is usually to be found on the plate. I have found when a surgical finding has been different from the X-ray finding a review of the plates usually shows good but unrecognized pathology present corresponding to the surgical lesion demonstrated. I am here making a plea for a careful and prolonged study of the plates taken, with great deference being paid to the experience of the roentgenologist in stomach interpretation.

One of the greatest follies, on the other hand, is for the surgeon or physician to ask for the plates, or worse yet, prints, so that he may be the final judge to pass upon the presence or absence of pathology.

A careful stomach examination should take 24 hours, or in some cases 48 hours; then, after the plates are dry, the roentgenologist should take plenty of time to study these plates carefully and then should demonstrate them to the clinician, who, with his knowledge of the history, arrives at a very accurate diagnosis.

How accurate this is, may be judged from a statement of Dodd, that in the suspected cancer cases examined in the Massachusetts General Hospital and later operated on, their conclusion as to whether pathology was present sufficiently marked to require operation or not was right in 96½ per cent. of the cases. And in the differential diagnosis between cancer and ulcer they were correct in 65 per cent. of the cases.

Cole made a very rigid test of the diagnostic value of the X-ray in a series of operated cases with Brewer. Twenty-seven cases that were to be operated on because of the clinical diagnosis of cancer or ulcer

* Read before the Hampden County Medical Society, April 20, 1915.

of the stomach, or duodenum, were sent to Cole for X-ray examination. He had no knowledge of the clinical findings, except, of course, that Brewer was to operate. The monograph published by them ends with the following:

"In summing up the evidence furnished by this series of 27 cases, it will be seen that of the 22 cases in which a definite diagnosis was made by the roentgen method, subsequent operation proved that in 20 instances this diagnosis was correct, and in 2 it was incorrect. In 11 of these cases the diagnosis was a negative one regarding the presence of a gastric or duodenal lesion, although the clinical history so strongly suggested ulcer or carcinoma as to justify exploratory operation. In not one of these cases was an organic lesion found to exist. In the five instances in which the roentgenologic diagnosis was not definitely stated, owing to incomplete observation, or unusual findings which could not be definitely interpreted, and concerning which only an opinion was expressed as to the probable lesion present, the opinion proved to be correct in four instances and incorrect in one instance. In other words, in this particular series, a correct diagnosis was made by serial roentgenography in 89 per cent. of the cases."

To ascertain as near as possible how correct had been the roentgen findings in the cases that had been sent to me, I recently sent out lists to the various physicians who had referred cases to me for diagnosis of stomach condition asking for the subsequent history relative to the correctness of the diagnosis as found at the time of the examination. I only covered a period of about two and one-half years, as previous to that time methods were so undeveloped that results were rather unsatisfactory. Neither did I ask for results since last December, as time enough had not elapsed in many cases to prove or disprove the diagnosis made. This latter ruling eliminated many very interesting cases, but it seemed only equitable.

Letters were sent to ninety-one medical men. This large number shows that there must have been varying degrees of work put upon the cases previous to my examination. Thoroughness of the study previous to my examination tends toward not only the ease but accuracy of my diagnosis, as my attention and examination can be directed with more thoroughness to the questionable part.

The number of cases inquired about in this series was 315. In each case at the time of the examination a definite X-ray diagnosis had been recorded as to whether pathology was present or not, and, if so, what the nature of it was. Of the ninety-one inquiries sent out, seventy-two physicians were kind enough to reply either by letter or in person, covering 282 cases. Of this latter company, the physicians had lost sight of 42, leaving 240 cases reported upon. Of these 240 cases concerning whom I had been able to learn the later history, I had made a negative diagnosis as to stomach pathology in 86. In other words, I believed them to be normal cases as to stomach or duodenal conditions. This leaves 154 cases in which X-ray diagnosis was positive of pathology. Ninety-six of these cases were treated medically and 58 operated upon. At this point we might produce an argument whether or not a conclusion could be arrived at as to proof of lesion except in operated cases. I feel I am right in ruling to include all of the 240 cases as the result of proper treatment is as actual proof of diseased condition as laparotomy by some operator.

The negative diagnoses should be included as those in many cases were hardest to make with positiveness as well as the most difficult to obtain the subsequent history. Of the 58 cases with pathology reported and operated on, 2 were reported with normal stomachs. This is a percentage of 96.6 correct diagnoses as to pathology. As to the differential diagnosis between cancer and ulcer, the accuracy cannot be as great as in most cases specimens were not taken for the pathologist. Of these operated cases, the X-ray diagnosis was cancer in 34 cases, while 24 was ulcer. These cases, analyzed as best I can from the re-

ports obtained, show in the differential diagnosis 82 per cent. correct.

If now we turn to the larger number or all cases reported back to me, I find of the 240 cases the diagnosis of the presence or absence of pathology has been confirmed by the attending physician or surgeon in 88 per cent. of the cases—doubtful in 4 per cent. of the cases, and a known error in only 8 per cent. of the total number.

I don't know how interesting this concrete presentation of percentages may be to the fellows of this Society, but I hope many will be glad to know just what can be accomplished in our own county. It is of very little value to the local practitioner to know that Holtznecht, of Vienna; Holland, of Liverpool; Pirie, of Montreal, or even eminent roentgenologists of Boston or New York, can be relied upon to get accurate diagnoses in a relative high number of stomach diseases. Few cases can be sent to these eminent gentlemen; the majority must be diagnosed locally.

The details of technique of a stomach examination I do not believe are of interest to this Society, so I will refrain from taking your time. Suffice it to say that each roentgenologist will work out for himself a method which to him is the best, and the closer he adheres to this personal method, if he follows up his cases, the greater will be his diagnostic acumen.

Personally, I like to have these patients come as early in the morning as possible, without breakfast and without previous preparation. I adhere strictly to subcarbonate of bismuth as a shadow-giving medium. The only argument I have heard advanced for other substances is expense, which to my mind is no argument at all. No harmful effects have come from the use of bismuth and if presented to the patient nicely it is not unpalatable; a point of not a little importance. How much the stomach is under the influence of the mind and emotion is not enough recognized in stomach examinations. In some persons a disagreeable sight, odor or thought will produce anti-peristalsis even to the point of vomiting. This is one of the sources of error in tube examination not to be too little thought of.

At the time of this first examination the choice of fluoroscopic or serial plate examination must be made. My personal experience shows both are needed in some cases, while in many one alone will suffice. All disease in the œsophagus and cardiac end of the stomach are best shown by the fluoroscope with the patient upright. The activity of the stomach as well as spasm of any portion is best seen with the fluoroscope and the patient prone. For detail, however, of the shape assumed in various phases of stomach and pyloric contraction, nothing can approach a number of plates as advocated by Dr. Cole, of New York. A careful study of such a series of plates will show to the man skilled in such an examination the smallest abnormality and may be by him interpreted into an exact diagnosis.

In six hours the patient returns to see if the bismuth has all been expelled from the stomach. A residue at this time is abnormal but not in itself evidence of pathology. Taken, however, with other findings, it is of the greatest value. No other method of examination has evidence equal to this dence equal to this roentgen method for stomach conditions at this period of digestion. It is self-evident if the stomach contents are removed one cannot tell what would have occurred had it remained longer.

After this six-hour examination, an examination is made at a time when I expect to find the bismuth at the ileocecal valve. This is usually done fluoroscopically, as I have found it of the greatest importance to see whether this valve is able to prevent large bowel contents from going back into the ileum when pressure is applied. The cases of reflex trouble with the stomach are little understood. Disease at the lower end of the cecum, either of the valve or the appendix, as well as gall stones, is responsible for many a diagnosis of indigestion or even more definite stomach lesion, when as an actual fact no trouble in the stomach *per se* is present. No possible way of positively finding such trouble outside the X-ray exists.

AN ACCESSORY SINUS ANGLE FINDER

By FREDERICK MANWARING LAW, M. D., New York

IN order to obtain a satisfactory antero-posterior image of all the accessory sinuses at one exposure, it is necessary that the rays pass through the head at a certain angle. If this angle is not observed, the petrous portion of the temporal bone obstructs the view of the ethmoids or antrum, or the sinuses are so distorted that the information given is not correct.

The proper angle is one which will cause the shadow of the petrous portion to cut across the lower one-third of the orbit, leaving the lower two-thirds of the antrum free and also the upper two-thirds of the

orbit clear. The superior portion of the antrum is not so important as any condition affecting the antrum to the extent of an X-ray diagnosis will involve the inferior portion as well. The possible exception to this is in the case of a fracture involving the lower orbital margin. In this case the petrous must be thrown downward into the antrum.

The position described shows clearly all that is required of the frontals, ethmoids, sphenoids and antra on a single plate, and the sinuses in their proper relation and size.

To obtain this position the principal ray must be directed through the head at an angle of 23 degrees from a line extending from the external auditory meatus to the glabella.

This angle may be obtained by a pair of dividers or a permanent triangle set at an angle of 23 degrees.

The patient is seated before an adjustable stand or may lie prone on a table, the head resting face downward with the nose and forehead upon an inclined plane, the inclination being such as to be comfortable to the patient, the head rest shown in the illustration having an angle of 20 degrees. If the patient is sitting, an adjustable rest is necessary to accommodate for the difference in the length of neck and shape of the head.

The tip of the angle finder is placed opposite the glabella, the left arm passing across the external auditory meatus, the right arm extending upward alongside the cone and representing the direction of the principal ray. The cone is now brought in alignment with the arm of the finder and brought down onto the head, making firm pressure.

This angle finder need not be adjustable as shown in the illustration, but can be made of a piece of flat metal about one-half inch wide, with one short arm of six inches, to extend from the glabella to the external auditory meatus and a longer arm of 16 inches to indicate the direction of the principal ray, the two arms making an angle of 23 degrees with each other. These arms are brought to a point and fastened in place, the two held at the proper angle by means of a metal brace across the two at the upper end of the short arm.

There are cases in which this angle will prove to be incorrect, but it works out very satisfactorily in the majority.

INSULATING COMPRESSION RING FOR ACCESSORY SINUS ROENTGENOGRAMS

Most all compression cones are made of metal and attached to a metal tube stand. This makes the necessary pressure for satisfactory sinus exposures painful to the patient and necessitates insulating the stand. To obviate this a simple addition is made to the cone by splitting lengthwise a piece of one-half inch rubber tubing cut to the circumference of the base of the cone, fitting this over the metal edge and fastening in place with a lacing of cord across the two ends. This makes a soft pad to make pressure on the head and insulates the end of the cone from the head.

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EDITORIAL

It is our pleasure to announce a change in the publication of the *Journal.* The Society has been fortunate in securing the coöperation of Mr. Paul B. Hoeber, who will act as publisher of the *Journal,* with the office of the publication at Nos. 67-69 East 59th Street, New York City. The editorial office will remain at No. 32 Adams Avenue West, Detroit, Michigan. The editorial staff has been enlarged by the appointment of a board of associate editors, a move which will tend greatly to advance the interests of the *Journal.* The publication committee has decided, in order to start the new volume after the beginning of the year, to make the next two issues multiple numbers.

Several new departments will be started during the coming issues—first, a department of laboratory notes, in which will appear many points on laboratory technique; second, a department of inquiries, which will be open to the subscribers of the *Journal,* in which the various questions which come up with regard to trouble with apparatus, technique, etc., can be sent in and will be referred by the editor to some one competent to answer (these inquiries, however, cannot take up the comparative merits of different types of apparatus); third, a department of dental radiography; fourth, a column of exchange and wants. In this column, which will be under the supervision of the publisher, apparatus can be offered for sale or exchange.

Other changes and improvements will be announced in forthcoming issues.

CORRESPONDENCE

AMERICAN JOURNAL OF ROENTGENOLOGY.

Gentlemen: Referring to Dr. A. W. Crane's article on the priority of Americans in the use of bismuth for the examination of the human stomach, I would allude to my own article entitled "Some Physiological and Anatomical Questions Regarding the Stomach," published in *Medicine* (defunct) February, 1898. After considerable preliminary work, along both radiographic and fluoroscopic lines, most of it being naturally mainly negative, a definite attempt was made to locate capsules containing tablets of iron, by *x*-rays and the fluoroscope on February 9, 1897. The tablets could be seen when held in the closed hand, or while in the mouth, but not after being swallowed—undoubtedly owing to lack of power of the apparatus used. March 13, 1897, at the Dental Department of the University of Buffalo, at a demonstration of *x*-rays by Prof. Van Woert, he kindly allowed me to make some further experiments, using radiography. A cent was strapped over the umbilicus and a 12-minute exposure was made. A circle probably corresponding to the coin was seen but not the capsule. About July 1, 1897, further experiments were made by the courtesy of Dr. Detweiler, of Philadelphia, who was then demonstrating *x*-ray apparatus in Buffalo. In three cases, iron tablets inclosed in capsules were observed by the fluoroscope, the peristaltic movements being plainly visible. The movements explained the failure of the previous attempt at radiography by time exposure. As the apparatus available at that time was not considered powerful enough for instantaneous radiography—this term, of course, not being used at the time—no further efforts were made in this direction. Instead of "skiagraphic" attempts, the fluoroscope was used, both iron tablets and bismuth powder being administered in capsule. In two or three instances, a few minutes after giving capsules containing bismuth powder, the whole gastric area became visible as a faint shadow, the inference being made at the time that this was due to the distribution of the bismuth over the mucous membrane, after the melting of the capsule. The shadow corresponded with the area determined by auscultatory percussion. "In the remainder of the patients" (about ten in all) "the test either failed entirely or was too faint to be relied upon." "In general, the thinner the patient, the clearer the shadow." A verbal report was made of these experiments to the Buffalo Academy of Medicine, in the fall of 1897.

Boas and Dorn reported essentially the same method, independently, early in 1898. Roux of Paris, however, seems to have anticipated my work by a few months, as I understand from conversation with him in 1908, that his experiments, reported in 1897, were actually begun in 1896 and were carried to a relatively successful issue in the winter of 1896-7.

As a matter of historic interest in regard to the priority of American physicians in roentgenologic studies, it should be stated that my attempts in 1896-7 to secure a shadow, by fluoroscope or photographic plate, of some innocuous substance—at first reduced iron, later bismuth—that could be

swallowed, were aided by a report of the fluoroscopic location of the stomach after the introduction of some instrument through the œsophagus, by Dr. Fenton Benedict Turck, then of Chicago. The exact date of his article I do not recollect, but it was published, or at least came to my attention, after the appearance of an article by myself in the *Philadelphia Medical and Surgical Reporter* (defunct), April 11, 1896, entitled "A Preliminary Report of Some Studies in Skiography" (last word printed thus). This article began with the explanation that I was not sure that the experiments detailed (two of them illustrated) dealt with roentgen rays. In the light of subsequent experience, the choice of the non-committal title-word, skiagraphy, is shown to be wise. Indeed, anyone who consults this article will readily see that I was entirely off the track and was merely experimenting with photography of much subdued light, with long exposures. The following statement may be of interest (quotation from article just mentioned): "Thus skiagraphy through any considerable thickness of tissue will yield vague outlines. Gall stones, either by the exact roentgen method or by any of the mere penetration methods used by the writer, are too transparent to leave their trace. The same may be said of all other pathological formations except those infiltrated with lime salts. Thus, skiagraphy, however conducted, is likely to be of more service to the surgeon in locating foreign bodies than to the physician. However, the writer has in mind an expedient for locating the lower curvature of the stomach which may prove successful and which will be reported favorably or unfavorably in due time."

The curious mixture of truth and error in this statement is worth considering in the light of after results and it will have been noted from the article first mentioned that the expedient for locating the lower curvature of the stomach did result favorably and, indeed, more favorably than was anticipated, for the non-toxic substance, swallowed in powder form, located practically the whole of the gastric area.

In an article entitled "Photography through Apparently Opaque Bodies," in the *Dental Practitioner and Advertiser* of April, 1896, I mentioned the same penetration experiments, spoke somewhat more optimistically of the possible development of the *x*-rays for investigating the stomach, gall stones, etc., and alluded to their possible use in dentistry and to obstacles at that time existing.

Without in any way failing to appreciate the value of the work of Rieder, it should be noted that the use of *x*-rays by American physicians for distinctly medical purposes, using large quantities of bismuth powder, mixed with water, mucilage, mineral oil (at lease by the present writer), test meals designed to suspend and diffuse the bismuth, etc., was common for several years before 1904. My own records show such use occasionally, and with no thought of originality. For instance, in August, 1904, a case of pyloric cancer with dilatation of the duodenum (cause unknown) was examined both by *x*-rays and auscultatory percussion, the results agreeing but leading to the erroneous conception of (cancerous) hour-glass stomach, until the necropsy allowed correction (reported in article in *N. Y. Med. Jour.*, Mch. 10, 1906). In January, 1904, a patient was examined for gall stones, the shadow being considered uncertain. In December, 1903, another patient was examined for

gall stones, the result being considered positive. Similar records occur for 1902 and 1903, which are all the more significant because, by this time, the writer had for various reasons abandoned personal investigations and was using the apparatus of men devoting their attention more or less as specialist, to the *x*-ray, both as a means of therapeutics and of diagnostics, and was consulting these men for assistance of a practical nature for which it was considered justifiable to ask patients to incur expense. It is scarcely necessary to state that the apparatus, methods of examination and skill available then were crude as compared with the present, nor that Rieder's publication in 1904 was of the utmost value. The fact remains that the *x*-rays were in common, practical, medical use in the average American city for several years before his work was known at all; that the successful beginnings of locating internal organs were made in this country seven years before Rieder's publication, that these were entirely independent of any European guidance of a medical nature and were antedated in the accomplishment of successful results by a few months at most—namely, by Roux of Paris. It may be added that probably the initial conception of a method of locating internal organs, by practical means which have been modified and improved upon but not radically changed, originated in America.

Very truly yours,
A. L. BENEDICT.

228 Summer St.,
Buffalo, N. Y.

ABSTRACTS

Müller, Christoph: Surgery or Radiotherapy? (Münch. med. Wchnschr., June 2, 1914, No. 22, p. 1226.)

Roentgentherapy has entered upon a new stage, that of deep therapy without injuring the skin, and the results thus far obtained have, in the minds of some, aroused the belief that the results obtained bid fair to rival surgery in the treatment of malignancies. Müller is evidently imbued with this hope, as the following abstract of his article demonstrates:

The feasibility of applying high doses to deep parts does away with the danger of exciting a cancerous growth. It is a justifiable assumption that the rays as well as any other agent with toxic effect have a stimulating action in small doses and a destructive action in large doses. This explains why the small doses of the former technic only brought about the very first stage of tumor involution, or a hyperemia of the pathological focus. This hyperemia causes an increase in the volume of the tumor and of the neighboring glands, as well as metastases, which by their very increase in size become amenable to diagnosis. Thus the rays have been credited with the property of favoring the growth of carcinoma, and when latent foci become recognizable from hyperemia, the idea was launched that the rays caused metastases. Hyperemia, however, always sets in with the involution of any tumor and is therefore the requisite first stage of recovery, and now that we are in a position to apply and continue the rays with increased intensity, the initial increase in volume should be hailed with delight as the first sign of a favorable reaction.

When deep therapy was introduced, the possibility of injury to the deep parts was animadverted upon. But no organic injuries have occurred due to high doses and extensive areas of treatment. There were typical blood changes which exemplify the desired result, but no injuries. They are the more characteristic, the more plethoric the organs and the higher the doses.

The fear of late injuries was doubtlessly exaggerated. Müller has not observed any late injuries in six years' practical experience. The few cases reported in the literature are susceptible of various explanations and in any case form an absolutely negligible exception as against the overwhelming numbers of treatments without such late reaction. Exceptions occur in any form of therapy, but they do not on that account condemn the entire therapy. The mere possibility of a late reaction is no contra-indication to X-ray treatment of malignant new formations.

The question should therefore be openly and honestly approached whether there is justification in suitable cases to give radiotherapy first choice in malignant new formation in preference to operation.

Recent congresses have conscientiously debated this point and, although no definite agreement was reached, the impression was created that radiotherapy of malignant tumors has proved by results to be a scientific mode of treatment and that its further development by experiments and tests must be the next and most important task.

The reason why the results up to recently have been of a modest nature lie in the first place in the imperfect technic and then in the fact that none but inoperable cases were accepted for treatment, cases which by reason of cachexia had lost all their recuperative power. Any form of therapy must fail under such circumstances. Tuberculosis as well as carcinoma can be successfully combated in the first stages, but this has not yet been done with regard to carcinoma except on the part of a courageous few.

These, however, can now point to splendid results. This does not mean that from now on, every incipient carcinoma should be treated by Roentgen rays first. What it means is that all radiotherapeutists who command the necessary technical and medical knowledge, should consider the advisability of not confining their efforts to inoperable cases which in the end are only fraught with disappointment, but of approaching operable cases too, thus furnishing material for testing the value of radiotherapy which can only be measured by the degree of success in operable cases. This would not work to the detriment of the patients either, because the time necessary to determine whether an operable tumor will react is so short with the aid of modern instruments and technic, that surgical operation can still be resorted to in time, and in any case the intense X-ray treatment will at least prevent the pathological process from progressing. If then radiotherapy proves a failure, so far as a cure is concerned, the operation can still be done with the same chances of success as if radiology had not preceded it. In carcinoma of the skin, cervix and mammæ, aside from myoma, radiotherapy has far outdistanced surgery, and the mortality statistics for operative interference in tumors of the internal organs are so heavy that radiotherapy in which the mortality is practically nil, should at once be given the preference from the start.

The general practitioner, therefore, when confronted with the question: radiotherapy or surgery? may conscientiously recommend the former, provided a competent specialist takes the responsibility.

The objection that the value of radiotherapy could not be acknowledged until the permanency of the cures had been proved, no longer holds good, because the number of successfully treated cases which have remained free from relapses for three years, are so large that it may be safely asserted that radiotherapy has a better record in this respect than surgery.

The usefulness of the knife is limited. In a mammillary carcinoma, for instance, one breast may be amputated, or both breasts and the regional glands. But that is where the knife's usefulness ends. With roentgen rays we are able to include the entire thorax and with it any pulmonary or pleural metastasis. Similarly, when the tumors are located in any other region, the application of the X-ray may be extended in any direction, laterally or into the deep parts.

Kaiser, F.: Roentgenological Studies on the Relation between Ossification of the Costal Cartilages and Pulmonary Tuberculosis. (Beiträge zur Klinik der Tuberkulose, XXXII, No. 1, 1914.)

The author examined 394 roentgen plates of 221 men and 173 women for the presence of an ossification of the first costal cartilage, and found it present in fifty-eight per cent. of men and women. Of these, again, forty-eight per cent. had pulmonary foci. Tuberculosis has a predilection for the pulmonary apex when the first pair of ribs is narrow and the cartilage ossified. The hilus glands are infected from some focus (usually the lungs) and in view of the apical predilection, foci are formed in the apex in the constricted groove of the first costal ring. If there is no anatomical or functional stenosis of the apex, all parts of the lungs are uniformly affected by tuberculosis.

Payr, E.: Gas Phlegmons in War. (München. med. Wchnschr., LXII, Jan. 2, 1915, p. 57.)

In times of peace gas phlegmons constitute an occasional, though a very serious, complaint threatening not only the injured parts, but even life. In war-time, one encounters a great many gas phlegmons following in the wake of a variety of wounds, more particularly those due to shrapnel splinters.

There are two forms of the affection, one malignant, spreading with incredible rapidity and usually terminating fatally, which even early amputation is unable to prevent.

In the second form of the affection, the gas phlegmons are, for the most part, entirely in the subcutaneous tissues. In these latter cases, the skin is edematous, and exhibits a peculiar orange discoloration which later turns to copper red. These forms of gas phlegmons are characterized by their epifascial course. In the malignant cases, the phlegmons are deeper, so that they may be classified as subfascial. They, indeed, fully deserve to be called malignant, for they spread with alarming rapidity along the intramuscular planes, changing the musculature to a soft chocolate-brown moist paste. The skin over the affected limb has a more somber tint, without displaying the previously described characteristic color phenomena. Death usually occurs quickly, due to progressive physical thrombosis and gangrene of the affected limbs.

It is highly important to make diagnostic and therapeutic distinction between these two forms of gas phlegmons. Mistaking the deeper cases, omitting to make extensive incisions or to amputate a limb, is punished by a fatal course, while attributing exaggerated importance to subcutaneous phlegmons gives rise to mutilations for which, in Payr's experience, there is no necessity.

Cole, L. G.: Technique and Experimental Application of Hard Rays for Deep Roentgentherapy. (Surg., Gynec. & Obst., 1915, XXI, 403, October.)

The author recites a number of experimental observations which he believes demonstrate the following:

1. That most of the rays from the ordinary tube, operated at its greatest penetration with a standard "transformer," are absorbed in the first inch of the tissue, if no filter be interposed.

2. That with the ordinary tube, operated to its fullest capacity on such an apparatus, no filter being interposed, eleven and one-half minutes are required to obtain an erythema dose three inches below the surface and that sixteen times an erythema dose is meanwhile administered to the skin.

3. That with the Coolidge tube a full erythema dose can be administered to the surface in thirty seconds, if no filter be interposed.

4. That with the Coolidge tube four Hampson units can be applied to the surface in one minute, through three millimeters of aluminum.

5. That with the Coolidge tube a dose of four Hampson units can be obtained three inches below the surface in six minutes through six ports of entry, using a three-millimeter filter.

In the final work, the treatments were given with an eight-inch spark gap, ten milliamperes passing through the tube.

Cabot, Hugh: Errors in Diagnosis of Renal and Ureteral Calculus. (Surgery, Gynecology and Obstetrics, 1915, XXI, 403, October.)

Any attempt to estimate the nature of frequency of errors in diagnosis of stone in the kidney and ureter is handicapped at the outset by the well-known fact that only a small proportion of the errors are either entered upon the record or reported.

In a recently undertaken study of 153 cases of stone in the kidney and ureter at the Massachusetts General Hospital, it was noted that 26 abdominal operations had been done upon these patients without relief of the symptoms, which were clearly due to the overlooked calculus in kidney or ureter. The appendix was the most frequent sufferer and was removed in 10 cases, without benefit. What are described as exploratory laparotomies came next in frequency, with 8 cases. Fixations of a kidney supposed to be movable and producing symptoms followed in order with 4. Then came removal of tube and ovary, unsuccessful search for gall stones, an attempt to relieve adhesions which did not exist, stripping of the capsule of the kidney for nephralgia, and, as a crowning iniquity, suprapubic cystotomy on

a normal bladder for a stone which was situated some two feet away. Each of these monumental blunders has one representative.

It has generally been believed that such errors could be avoided by the routine examination of the urine, but in fourteen per cent. of the cases of this series, the urine was entirely normal.

Much reliance has been placed upon the X-ray in cases of abdominal pain of an obscure type, and it is interesting to inquire how frequently the X-ray fails to detect stone. In 127 cases in which satisfactory X-rays were obtained, 8 were entirely and persistently negative, which represents a failure of six per cent. This is, Cabot believes, considerably short of the real percentage of failure, because in many of these cases X-rays were repeatedly taken over a period of weeks or months, and if a positive plate was finally obtained, sight of the negative ones is entirely lost. Cabot is inclined to think that fifteen per cent. is nearer the percentage of failures, even in the hands of thoroughly expert roentgenologists. In fact, the author declares that, to the trained urologist the most interesting man-traps are those set for him by his association with an imaginative roentgenologist!

He concludes that the evidence presented by the X-ray alone is insufficient to warrant operation in most cases of stone in the kidney or ureter. The possibility of error may be diminished by the use of the ureteral catheter, stereoscopic plates, pyelograms, or the wax-tipped catheter.

In cases with symptoms suggesting stone in the kidney, with a normal urine, a negative X-ray, and an unobstructed ureter, the wax-tipped catheter will not infrequently lead to a correct diagnosis and will be likely to fail only in the cases in which the stone lies in a dilated calix and is therefore out of reach of the catheter.

Schwarz, Gottwald: Roentgen Demonstration of Gas Phlegmons. (Wien. klin. Wchnschr., Jan. 28, 1915.)

Schwartz points out that the malignity of gas phlegmons has lost some of its terrors owing to the experience gathered in the present great war. Previous to incision, the roentgenogram may indicate the presence of gas phlegmons. The shadows of the soft parts present round or oval spots, partly isolated and partly confluent, forming hollow spaces which appear dark on the negatives and light on the positives or the screen. The gas spots may well be compared to the holes in certain cheeses which, indeed, are due to an analogous cause.

Levin, Isaac, M.D., New York City: The Efficiency of the Coolidge Roentgen Ray Tube and the Rationale of Radiotherapy in the Treatment of Malignant Tumors. (Surgery, Gynecology and Obstetrics, September, 1915, vol. xxi, page 374.)

Comparative experiments were done by Levin with the Gauss and the Coolidge tubes, using a very heavy German coil as a generator. But tubes were placed approximately under similar conditions; i.e., the same voltage of primary current was sent through the coil, nearly the same number of milliamperes of high-potential current were sent through the tube, and the resulting Roentgen rays showed the same penetrating power.

To study the distribution of the rays, pieces of meat of certain thickness and also living animals (pigeons) were radiated. Test strips of photographic paper (Kienboeck strips) were placed on the surface of the radiated piece and at various depths of tissue. Pieces of meat were used, one, one and a half, two, three and four inches in thickness. The very soft rays, which usually act only on the surface of the skin of the animal and are not selective but caustic in their action, were absorbed by a plate of aluminum 3 mm. in thickness, and a layer of chamois leather 2 mm. thick placed between the tube and the tissue. This filtration was selected as being identical with the filtration used by the writer in his clinical work. The pigeons were placed in a box four inches deep. One Kienboeck strip was placed over the box and the other un-

der the box. The accompanying illustration shows the records of two experiments: (a) an experiment with four inches of meat and a Gauss tube; (b) an experiment with four inches of meat and a Coolidge tube; (c) shows the Kienboeck quantometer and the method of estimation.

the quantity shown on the surface. There is no complete regularity in the results of the experiments with either tube, but the Coolidge tube shows a far greater uniformity. The reason for this superiority shown by the Coolidge tube is probably due to the following: The Roentgen rays emitted by

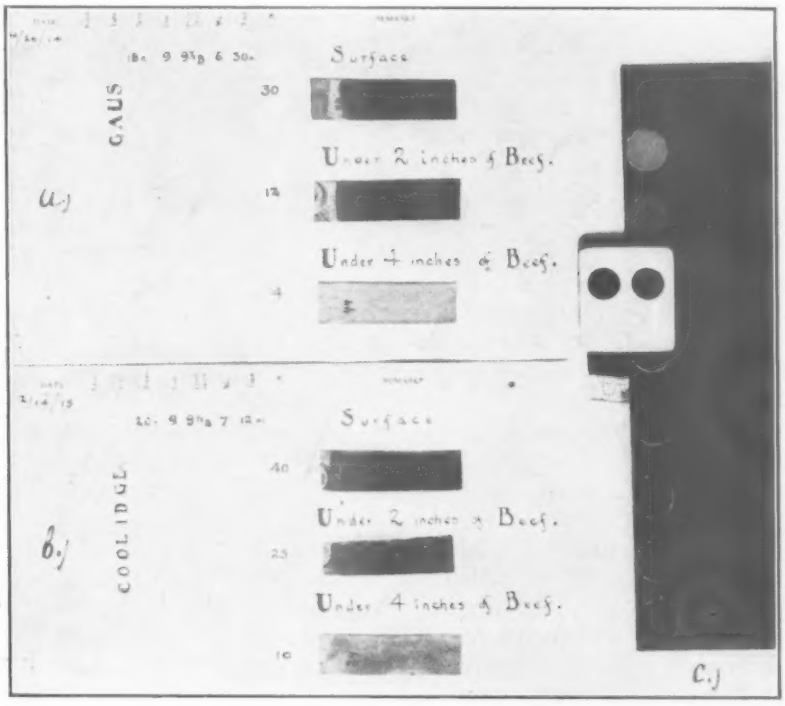

FIG. 18. Records of two experiments. *a*, An experiment with 4 inches of meat and a Gauss tube. *b*, An experiment with 4 inches of meat and a Coolidge tube. *c*, The Kienböck quantimeter and the method of estimation.

The results of numerous experiments may be summarized as follows: To obtain the same quantity of rays on the surface with a Coolidge tube takes about one-third of the time that was required with the old-type tubes. At the depth of two inches of meat the strip shows about one-third the quantity of the rays shown by the surface strip during the same experiment with an old-type tube and about one-half by the Coolidge tube. At a depth of four inches there is usually about one-seventh of the quantity shown on the surface obtained from a Gauss type, while from a Coolidge tube one obtains at the same depth usually one-fifth of

a tube are never uniform in their character and represent all grades of hardness. The methods of measuring the penetration of the tube reveal only the hardest rays. Apparently the rays are more uniform in the Coolidge tube and a greater proportion of the pencil of rays are of the hardest quality, and therefore a higher fraction of those entering the surface reach a certain depth. Another great advantage of the Coolidge tube consists in the fact that when it is once regulated to a certain penetration it remains so for an indefinite period of time. On the other hand, it must not be presumed that the rays of the Coolidge tube have an

unlimited capacity of absolute penetration.

Excluding epithelioma of the skin and cases in which treatment began too recently for a correct analysis, Levin treated, during the last eighteen months, 41 cases of deep-seated malignant tumors with the modern methods of radium and Roentgen therapy. The conditions were distributed as follows: Carcinoma of the breast, 9; carcinoma of the mouth, 6; carcinoma of the larnyx, 1; carcinoma of the œsophagus, 3; carcinoma of the uterus and vagina, 7; carcinoma of the ovary, 1; carcinoma of the urinary bladder, 1; carcinoma of the stomach, 4; carcinoma of the sigmoid and rectum, 5; sarcoma, 4.

Of these cases, 13 died, 11 discontinued treatment, 14 remained unimproved, and 3 seem to be at present clinically cured. At first glance these results do not seem to be gratifying, the more so that even the clinically cured cases, which represent 7.5 per cent. of all cases treated, have not been observed long enough to give any certainty as to the permanency of the results. On the other hand, considering the hopelessness of the class of cases that came under treatment, the results are by far superior to anything which was attempted with this class of cases previously. Moreover, in several cases which did not improve clinically under treatment, morphological changes were noted in the tumors which strikingly indicate the value of radiotherapy in the treatment of malignant tumors, when the class of cases, the time, and the method of treatment are selected correctly.

Levin analyzed 1,002 cases. Of these, 57 cases were clinically cured, and 51 cases became operable. There are reported in all 58 cases treated by radiation alone, which were in an operable stage. Of these, 35 cases belong to Doederlein, and were not included in the calculation. The 21 cases of Wertheim must be deducted from the sum-total of cases treated, but not from the clinically cured cases, since Wertheim does not give the number of clinically cured cases. The 2 operable cases of Chevron and Duval must be deducted both from the sum-total and the number of clinically cured cases. There remains a total of 979 cases, of which 55 are reported clinically cured. Of the 51 cases which became operable, at least 25 per cent., or 12 cases, must have also become clinically cured. This gives a total of 67 cases or 6.7 per cent. clinically cured.

Frank, Robert T., A.M., M.D., New York City: The Choice Between Operation and Roentgenization of Uterine Fibroids. (American Journal of Obstetrics, September, 1915, vol. lxxii, page 408.)

Frank is of the opinion that conservative gynecologists will be forced to exclude from Roentgen ray treatment cases in which the palpatory findings are not quite clear (impacted, adherent, partly cystic masses), tumors growing rapidly, or large tumors in which the entire endometrium cannot be curetted away for examination. In other words, the very cases in which the operative mortality is from 1.5 to 2 per cent. are excluded from the benefits of the rays. In the uncomplicated cases the operative mortality is 0.75 per cent. As Roentgen ray treatment of fibroids is an expensive procedure, costing between $100 and $500 (depending upon whether the fractional Albers-Schoenberg, or the intensive [Freiburg] method of application is used), the poorer patients are automatically excluded, except in well-endowed institutions. The time required to produce amenorrhea in most patients under forty years of age is at least two to three months. If the bleeding has been irregular in character, roentgenization must be preceded by curettage and examination of the scrapings. In addition, the suspicion of complications makes the choice of Roentgen ray hazardous.

Because of these requisites (expense, time, curettage, absence of complications), Frank has found it inadvisable to use Roentgen ray treatment in fibroids except in very rare instances. Where necessary, or indicated, however, he believes the method is invaluable; thus: (1) if operation is absolutely declined; (2) in patients with severe

heart disease or grave nephritis who are bad operative risks, and, finally, (3) in a very small group in whom the psychical trauma of operation must be avoided at all costs. These cases have constituted at the most between five and six per cent. of all fibroids seen in Frank's private hospital and dispensary experience.

While the Roentgen ray has been a great and indispensable boon in the control of obstinate puberty menorrhagias and metrorrhagias, or similar bleeding occurring during the early years of maturity, Frank says its use for fibromyoma is less necessary, though within strict limitations valuable.

Frank claims that the Roentgen ray cannot be used with safety in rapidly growing tumors; in cases of metrorrhagia where complete preliminary curettage with microscopical examination of the curettings is not feasible; in complicated cases where ovarian cysts or serious adnexal trouble cannot be excluded; in fibroids complicating pregnancy. The rays should not be used where expense is a factor, or where time is a factor. The rays are of chief value where operation is declined, where operation is contraindicated by serious heart, renal or pulmonary lesions, or where operation is contraindicated because of extreme psychical unrest. Consequently, Roentgen ray treatment is applicable to, at the most, five to six per cent. of all patients having fibroids.

Stern, Samuel, M.D., New York City: Roentgen Ray Treatment of Uterine Fibroids. (American Journal of Obstetrics, September, 1915, vol. lxxii, page 396.)

According to Stern, the dangers connected with the Roentgen ray treatment of uterine fibroids as administered to-day, with proper technic, are practically *nil*. By carefully measuring the dosage, using rays of proper penetration, filtered through aluminum and other filters, the danger of producing a severe Roentgen ray dermatitis has practically been eliminated. The majority of the patients Stern treated had large fibroids, reaching up to the umbilicus. He has found it extremely difficult to produce a complete and permanent amenorrhea in very young women.

In one case of a woman of thirty-two years he was compelled to give nine complete series, with some intravaginal raying, until he finally succeeded in producing an amenorrhea, which, although lasting for six months now, he is not at all convinced will prove permanent.

The fibroid, which originally reached up to the umbilicus, is hardly palpable at present, and the last few menstruations she had preceding the amenorrhea were practically normal. Stern thinks a temporary amenorrhea with a diminution of the fibroid and normal reëstablishment of menstruation is much more ideal, and says this can often be accomplished.

At present he is using rays of slightly above 10 Bauer, equaling a 9-inch spark gap. He has also substituted a 4-mm. aluminum filter instead of a 3-mm., for additional safeguard against a dermatitis.

The amount of rays administered to each field at present is 20 X, measured under 4-mm. aluminum. Even the most sensitive skin will tolerate this. Stern has never seen anything worse develop than a slight superficial redness, which generally disappears in a few days.

Up to the present time he has treated about one hundred cases of uterine fibroids, twenty-two of which were treated in strict adherence to the Freiburg technic. Of these, four were recent cases, still under treatment. One patient had a severe Roentgen ray dermatitis, produced by previous treatment. This patient was extremely anxious to avoid an operation, so Stern attempted to treat her by blocking out carefully the affected area and treating all around it. The area he had to block out was considerable; on account of this, he was unable to give her anything like the quantity of ray she should have received. This patient received three series, when, on account of the urgency of the symptoms, it was necessary

to discontinue treatments, and the patient had to undergo an operation. Stern is convinced that with the proper technic this dermatitis might have been avoided and the patient saved an operation. He succeeded in getting a permanent amenorrhea with a diminution in size of the fibroid, in every patient over forty years, 100 per cent.

The average length of time necessary to produce amenorrhea was about six weeks (three series), although a number became amenorrheic in less time than this (two series). The average number of series given were between four and five. The nearer the climacteric period, the easier amenorrhea was produced, and the less series necessary.

In a patient treated below forty years with the Freiburg technic, Stern succeeded in getting a very marked diminution of the fibroid with an amenorrhea which may or may not be permanent. He says that the number of series required in these patients is considerably more than in those above forty years.

Probably one-half of the patients treated had a "Roentgen Kater" in various degrees of severity, lasting from one day to a week.

Stern emphasizes the dangers of Roentgen ray therapy in the treatment of uterine fibroids, with proper technic, are absolutely none. In cases where we want to establish a permanent amenorrhea, the massive dosage method (Freiburg technic) is decidedly superior to the fractional dosage method, as giving quicker and more satisfactory results. In younger women, where we merely aim to get a diminution of the size of the fibroid, with a temporary amenorrhea and a reestablishment of menstruation, the fractional dosage method is preferable. In these cases, in a comparatively short time after the reëstablishment of menstruation, the patients may conceive, go through a normal labor, and give birth to normal children. All uncomplicated cases of uterine fibroids are amenable to Roentgen ray treatment. The nearer the patients are to the climacteric period, the surer and quicker the results. In these cases, properly treated, we can look forward to getting practically one hundred per cent. cures.

Aaron, Charles D., ScD., M.D., Detroit, Mich.: **The Roentgen Ray in Gastro-intestinal Affections.** (The American Journal of the Medical Sciences, September, 1915, vol. cl, p. 330.)

In reviewing the literature on roentgenology, one recognizes that for a number of years most of the advancements in this specialty have come from the same contributors. The men who are maintaining high standards of work are few, and as a consequence the physician is often obliged to accept the interpretations of inadequately prepared roentgenologists. The apparent simplicity of this science has caused a number of men to follow it who have not the necessary preliminary training to properly qualify them for their work.

The subject is new, and its literature, particularly in English, is so scant that one who is seeking to perfect himself in this specialty is able to find but few reliable sources of information. The isolated observations and occasional monographs are not always readily accessible. The courses offered for the study of roentgenology in both graduate and undergraduate schools are limited, and the amount of time that can be devoted to the subject by the undergraduate is restricted. The average post-graduate schools do not give the thorough training which is so much to be desired, because the time allotted is too short and the number of cases completely studied far too few.

There is a lack of uniformity in the methods of roentgenological examination followed by specialists of apparently equal standing. To illustrate: There is no standard or test meal for roentgenographical examination of the gastro-intestinal tract. The American, German and English test meals differ. Such a standard meal is as necessary for roentgenographical examination as the Ewald test breakfast for chemical analyses. A standard test meal would obviate the

necessity of always specifying which opaque salt was used.

Physicians without sufficient experience in roentgenology often draw erroneous conclusions, and their patients are frequently subjected to improper treatment because diagnoses are made from incomplete roentgenographical findings, based on too few plates or a hasty fluoroscopical examination. Such inaccurate examinations are allowed to displace the ordinary routine diagnostic methods, and, as a frequent result, the patient is treated medically or surgically for a condition that does not exist.

An accurate knowledge of the pathology that is subject to roentgenological examination is necessary for decisive interpretations.

The Roentgen ray diagnosis of pronounced gastric pathology is comparatively easy. Definite lesions, which are conspicuous at autopsy or operation, are readily recognized. The recognition of an hour-glass stomach, a perforating ulcer of the stomach, or an obstruction of the pylorus is not very difficult. The statement has been made that fully ninety-five per cent. of patients with so-called stomach symptoms are not really suffering from gastric disease, but from some other abdominal disease, as chronic appendicitis or cholecystitis. The roentgenologist should therefore have the special training that is necessary to enable him to discover by the Roentgen ray the remote lesion that is the cause of the patient's symptoms. These cases of reflex irritation in which the pathological condition may be in the gall-bladder, in the appendix, or in the colon, offer the roentgenologist his most difficult problem and an opportunity to show his experience and the refinement of his technic.

In order that the limitations and possibilities of Roentgen diagnosis may be established, it is necessary to secure a standardization of methods and technic.

Aaron's recommendations are: (1) That the roentgenologist should be a trained and experienced anatomist and pathologist. (2) That there should be standardization of methods and technic. (3) That the physician acquire the ability to properly estimate the diagnostic value of a Roentgen ray report. (4) That the patient should not be subjected to operation without a confirmation of the original findings by a second Roentgen examination made after an interval of two or three days. (5) That the clinician must not attach too much significance to the Roentgen ray findings unless they are absolutely decisive. (6) That the lesion discovered by the Roentgen ray must be a constant finding, regardless of position or slight variations in technic. (7) That great care must be exercised to differentiate physiological and spastic conditions from those that are essentially pathological. (8) That the Roentgen ray report should be considered on the same basis as any laboratory report. (9) That the physician must carefully correlate the Roentgen ray findings with the anamnesis and the clinical and laboratory findings.

The Standard Meal in Intestinal Radiology. (The Lancet, July 24, 1915, vol. clxxxix, p. 187.)

The Section of Electro-Therapeutics of the Royal Society of Medicine appointed earlier in the year a sub-committee to consider and to recommend a standard opaque meal for radiographic examination of the alimentary canal. The following report has now been adopted:

1. The standard meal should consist of either bread and milk, or porridge (Note 1).
2. The total bulk of the meal should be about half a pint.
3. The meal should be mixed with two ounces of barium sulphate or two ounces of bismuth oxychloride (Note 2).
4. The meal should be taken as nearly as possible on an empty stomach.
5. No aperient or other medicine should be taken within thirty-six hours of the first examination, and if the bowels are not opened naturally, an enema should be given on the morning of the examination.

Note 1. (A) Preparation of bread and milk; two ounces of white bread, without

crust, cut into small cubes, are placed in the bowl from which the meal is to be taken. Eight ounces of ordinary or malted milk are boiled in a separate vessel with two ounces of bismuth oxychloride or two ounces of barium sulphate; this mixture is stirred and poured over the bread. Sugar is added to taste.

(B) Preparation of porridge: Seven ounces of porridge made from the finest oatmeal are mixed with two ounces of bismuth oxychloride or two ounces of barium sulphate, and sufficient milk to make the total bulk up to ten ounces. The patient adds as much brown sugar as he likes.

Note 2. (A) Bismuth carbonate neutralizes about 22 per cent. of the free acids of the stomach, but there is no evolution of gas, as the carbon dioxide is dissolved as rapidly as it is produced (H. Finnemore and A. E. Barclay). The reduction in the acidity of the gastric contents tends to reduce the motor activity of the stomach and to interfere with the normal action of the pylorus.

(B) 1.—Bismuth oxychloride is slightly more opaque to the Roentgen rays than bismuth carbonate (R. Morton). 2.—Bismuth oxychloride is about one and a half times as opaque to the Roentgen rays as an equal weight, and twice as opaque as an equal bulk of barium sulphate (R. Morton).

Note 3. Barium sulphate is preferable, at any rate for hospital use, as it is very much cheaper than bismuth oxychloride and equally good for radiographic examinations. By using barium sulphate, Guy's hospital has saved about fifty pounds per annum.

The observations in regard to the advantages of employing barium sulphate are of interest. As is shown, it is much more economical than the bismuth salts, but it is important that the barium sulphate should be absolutely free from soluble barium salts, which, as is well known, are decidedly poisonous. The report is signed by Dr. A. E. Barclay, Dr. A. F. Hertz, Dr. Reginald Morton, and Dr. S. Gilbert Scott.

Eisen, Paul, M.D., Chicago, Illinois: Roentgenoscopic Evidence in Appendicitis. (New York Medical Journal, August 14, 1915, vol. cii, page 352.)

When we give a patient a meal, either of buttermilk or of potato starch, which contains large amounts of bismuth or barium sulphate, we can see not only the lumen of the stomach and intestines, but also that of the appendix. How much or what part of the lumen of the appendix we can make visible in cases of appendicitis is the subject of this paper, based on the findings in thirty-six consecutive cases operated on by Dr. Carl and Dr. Emil Beck. Information of considerable value has been obtained from most of the cases which were suitable for examination. Such an examination most always gives valuable data, sufficient, in conjunction with other clinical findings, to warrant a laparotomy.

A normal appendix lumen does not rule out appendicitis. In two cases there was a stricture near the tip, and appendicitis distal to this stricture. In four other cases a negative Roentgen ray report was given, and still there was appendicitis at the tip. Eisen calls these cases drumstick appendicitis.

He has not only examined chronic and subacute cases, but also cases during an acute attack. These cases were operated immediately after the examination. Many cases of appendicitis operated were not fit for Roentgen ray examination. Which cases are unsuited for examination is left to the surgeon's judgment. He has had no experience in the examination of children, the ages of his patients ranging from sixteen to past sixty years.

A few patients had slight rises in temperature, none having high fever, and the pulse was good in every case. In no case was there rigidity of the wall of the abdomen, but one or two had pain on raising the right thigh. The clinical diagnosis was appendicitis in only a few; in most of the cases the diagnosis was doubtful, and in others ulcer of the stomach was the definite clini-

cal diagnosis. In a number there was a suspicion of involvement of the gall-bladder or duodenum; and in one the diagnosis was right movable kidney with some indefinite abdominal lesion. Here strawberry gall-bladder and drumstick-shaped appendicitis were found, with a negative Roentgen ray report. This was one of the four cases mentioned above.

In 30 out of 36 cases, however, a definite Roentgen ray report was sent in of appendicular involvement, and confirmed at operation. In 4 a negative report was sent in, but appendicitis was found, and in two cases a positive report was sent in and a healthy appendix removed in one, and a strawberry gall-bladder removed in the other case. These patients were nervous, were frequently examined, and experienced pain on examination.

Aside from the stomach symptoms suggestive of pylorospasm, the main Roentgen ray symptom of value in appendicitis is the direct location of pain or pressure, traction, or displacement of the appendix itself, or, if the lumen is invisible, of the point of its insertion at the cecum. This pain was elicited in all but four of the 36 cases, and in only two was a healthy appendix found. It is, therefore, in Eisen's opinion, the most reliable of all signs. In very few cases is this site of pain the same, varying practically in each case. In the four cases in which it was absent, appendicitis was at the tip of the appendix, thus explaining its absence.

Eisen has been unable to visualize a lumen in 14 cases, and in most of these cases there was no barium found in the lumen at operation. In a few the examination possibly was of too short duration, but in most of these cases the operation revealed sufficient explanation that no lumen was obtainable; either the lumen was obliterated totally, diseased at the base, totally inflamed and thickened, or filled with fecal beans and the like.

In the 16 cases showing a lumen, or parts of one, there was a certain regularity of findings so far as the lumen corresponded to that part of the appendix from the base where the lumen showed no signs of inflammation. In other cases, however, where bits of lumen showed, there was inflammation proximal to the barium in the appendix. In the old adherent chronic cases, the lumen would be visible even beyond a stricture or kink. On the whole, according to my experience, there is no set rule to go by. Each case is a study in itself and must be taken as such. In 13 cases membranes were found at operation, of which there had been no Roentgen ray evidence, and of which Eisen could find no evidence on the plates when examining them after operation. In a few cases a band would constrict the middle of the appendix, and up to this kink a lumen would be shown, and from this point to the tip the mucosa would be acutely inflamed. In the two cases of retrocecal appendicitis there was no direct evidence of this location of the appendix, as in both cases the appendix and cecum were one mass and could not be separated. In one case, in which castor oil had been given by mistake in the course of the examination, the cecum and appendix lumen were well filled with barium at the subsequent Roentgen ray examination and at operation half an hour later.

In five cases a pericholecystitis was found coincidentally, which was impossible to detect in the course of an examination. The adhesive bands were veil-like, just like the Jackson membranes seen in three cases, which also had given no Roentgen ray evidence of their presence.

In all female cases a thorough gynecological examination preceded the Roentgen ray study, and lately he and his associates have been also examining the ureters in cases which are the least suspicious.

Codd, J. Alfred, M.D., Wolverhampton, England: The Interpretation of Opaque Meal Shadows in Diseases of the Stomach. (The Practitioner, August, 1915, vol. xcv, page 181.)

The technic employed by Codd may be described as follows: The meal consists of 3 ounces of barium sulphate, pure from

soluble salts, 2 ounces of bread cut into small cubes, and 8 ounces of milk which is boiled, mixed with the barium sulphate, and poured on the bread, sugar being added to taste. No breakfast is taken before meal. The shadow is examined during and after deglutition, and again after four hours, eight hours, and twenty-four hours. No additional food is taken until the examination after four hours has been made. The movements of the stomach are carefully examined for a considerable period at each examination.

The method of entering the stomach is important. The stomach bubble can generally be distinguished before the food is taken. The food then slides down to the right or mesial side of the bubble, and forms an inverted wedge beneath the bubble. When the second bolus slides down the wedge elongates and the apical angle gets more acute. With successive boluses, the inverted wedge shape is maintained, portions slipping down to the fundus, until the apex of the wedge joins the fundus mass, and forms a slender J. The upper limb of the J thickens, and the fundus segment becomes more globular; when the full meal is taken, the general J-shape is retained for a time, gentle peristaltic waves passing over it, but the food gradually settles down, forming a truncated J or a hemispherical mass.

Normally, no food is seen passing through the pylorus, though a stream of very fine particles actually passes; a vague cloud beyond can be seen in a rapid exposure, and sometimes even on the screen. In four hours, two-thirds of the stomach contents should have gone, and the remainder should be either quiescent or presenting gentle movements. The wave should not bisect or nearly bisect the shadow. There should be food in the ileum and cecum, generally none in the jejunum, which from a Roentgen ray point of view generally deserves its name. In eight hours the stomach should be empty, and the food collected in the ileum, cecum and first part of the ascending colon. In twenty-four hours there is generally half the food in the ascending colon and the other half in the sigmoid and rectum, or even in the outer world. It is infrequent to catch it in the transverse colon, and when one does, this part of the gut is prolapsed, often right down to the pubes.

At his office, Codd uses the cylinder diaphragm, letting the end of the cylinder almost touch the patient's back. By this method he can get much better definition. At the hospital he uses a diascope, which, while presenting many inconveniences, has the tube too far away, necessitating more current and greater strain on the tube. On the whole, Codd says radiographs are of secondary importance. The frequent change in form of the shadow is more important than a few odd phases caught on the plate, though for such things as the pyloric cap, the shadow of an ulcer, and the shadow of the appendix, a radiograph of fair rapidity must be obtained.

The contour of the shadow is sketched on the lead-glass plate covering the screen by an oil pencil.

Carman, Russell D., M.D., and Miller, Albert, M.D., Rochester, Minn.: The Roentgenologie Determination of Gastric Motility. (Arch. of Internal Medicine, Sept. 15, 1915, vol. xvi, page 406.)

Carman and Miller have subjected approximately 10,000 patients to the Roentgen test, but have selected for tabular analysis and comparison those cases seen during the year 1914. In 1914, 4,118 patients were examined by the Roentgen ray for gastrointestinal disease. Of this number, 1,140 were operated on. In 950 of them a motor-meal test was also made by the gastroenterologist and the tabulation is based on these 950 cases.

For more than two years past their work has been based on the double meal method of Haudek, and they unreservedly endorse his claims. For various reasons, Carman and Miller have found it advisable to modify Haudek's technic in some particulars, but have retained the six-hour limit and adhered rather closely to his general principles.

A cereal porridge instead of a pap for the six-hour meal is employed, and barium sulphate substituted for bismuth salts. Since barium leaves the stomach earlier than bismuth, they believe that a six-hour retention of barium is even more significant than one of bismuth. Until the first of this year patients were required to take castor oil on the evening previous to the day of examination, but this has been abandoned as unnecessary. The observations of Hayes show that purgation results in a heightening of gastro-intestinal motility for a day or two. A comparison of observations during the past few months with those made previously indicates that this increase does occur, but that it does not materially affect the six-hour test. The routine followed by Carman and Miller now is as follows:

The patient comes to the laboratory in the morning without breakfast, and usually, but not always, after tubing and lavage by the gastroenterologist. He is given a meal consisting of four ounces of well-cooked wheaten breakfast cereal with two ounces of barium sulphate, to which he is permitted to add a little milk and sugar according to his taste. He is instructed to take neither food nor drink, except water, until the examination is finished. Six hours later he returns and the screen examination is begun. The presence or absence of a residue in the stomach from the motor meal is noted. The amount of retention is recorded on a scale of four units, each unit representing approximately a fourth of the meal. If the entire meal has passed into the intestine, its position and distribution are observed. The patient is then given two ounces of barium sulphate stirred up with eight ounces of water. Usually some of this escapes or can be driven through the pylorus, showing its condition as to patency. To complete the examination and to fill the stomach for roentgenography, the patient takes about twelve ounces of the potato-starch pap containing approximately three ounces of barium sulphate, after which the behavior of the stomach in all respects is watched.

The gastroenterologist's routine for examination of the gastric contents is the following: At 6 P. M. previous to the day of examination the patient takes a modified Riegel meal; that is to say, he is instructed to eat an ordinary meal, which must include bread, meat and potatoes. An hour later he eats twenty raisins, the skins of which are easy of identification, and tend to remain in the stomach somewhat longer than the usual food materials. The gastroenterologist's examinations are begun the next day, about 8 A. M., and, depending on the number of patients to be examined, the interval after the motor meal varies from fourteen to sixteen hours. The estimate of motility is based on the presence or absence of food bits or raisin skins from this meal, as shown by tubing at the morning examination. Residues are recorded on a scale of four. The gastroenterologist's technic also includes the

INCIDENCE OF RETENTION OF TEST-MEAL IN 950 CASES

	Total Number	With Residue (x-Ray)		With Food Remnants (tube)		With Residue (x-Ray) only		With Food Remnants (tube) only		With Both Residue (x-Ray) and Food Remnants (tube)		Number Without Residue (x-Ray) or Food Remnants (tube)	No. With Residue (x-Ray) or Food Remnants (tube) or Both
		No.	%	No.	%	No.	%	No.	%	No.	%		
Lesions of the appendix...	125	1	0.8	2	1.6	1	0.8	2	1.6	0	0.0	122	3
Lesions of the gall bladder.	311	10	3.2	5	1.6	7	2.2	2	0.6	3	0.9	299	12
Gastric ulcer.....	109	50	45.8	25	22.9	29	26.6	4	3.5	21	19.2	55	54
Gastric cancer.....	137	83	60.5	57	41.6	29	21.1	3	2.1	54	39.4	51	86
Duodenal ulcer.....	268	76	28.3	42	15.6	39	14.5	5	1.8	37	13.8	187	81
	950	220	23.1	131	13.7	105	11.0	16	1.6	115	12.1	714	236

administration of a modified Ewald test-breakfast for the chemical examination.

During the year 1914, 950 patients who had been examined both by the Roentgen ray and the test-meal went to operation. Two hundred and twenty-three, or 23.1 per cent., showed a gastric residue, at the Roentgen ray examination, from the six-hour meal. One hundred and thirty-one, or 13.7 per cent., had food remnants. In other words, the Roentgen ray showed approximately 70 per cent. more retentions than did the clinical test-meal. The lesions found were: Disease of the appendix, 125 cases; disease of the gall-bladder, 311; gastric ulcer, 109; gastric cancer, 137; duodenal ulcer, 268. The accompanying table shows the incidence of retention in each of these conditions, as shown by the Roentgen ray and stomach tube, respectively. The preponderance of six-hour barium residues over food remnants from the test-meal is noteworthy, being twice as great in gastric ulcer and lesions of the gall-bladder; almost twice as great in duodenal ulcer; and half again as large in gastric cancer. In the 125 cases with lesions of the appendix, a retention was noted by the Roentgen ray in only one case, and found in two cases only by the stomach tube. In only 12 of 311 cases with lesions of the gall-bladder was retention noted either by the Roentgen ray or by tubing. The vast majority (209, or 90.4 per cent.) of the 220 patients showing a barium retention were found at operation to have cancer or ulcer of the stomach, or ulcer of the duodenum.

In 16 cases representing all five conditions, the stomach tube revealed food remnants, while no six-hour retention of barium was found by the Roentgen ray. On the other hand, 105 patients had Roentgen residues but no food remnants.

In eight of the cases tabulated under gastric ulcer there was also duodenal ulcer. All of these patients showed a residue from the barium meal, and six of them had food remnants.

Besides the cases tabulated above, residues were found by the Roentgen ray in one patient in each of the following conditions: Cancer of the pancreas, tumor of the ileum, cancer of the common duct, hydronephrosis, tumor about head of pancreas, tumor of left kidney, subdiaphragmatic abscess, and cancer of the ascending colon. In the four first mentioned, retention was also noted by the gastroenterologist.

How can the discrepancy between the gastroenterologist's results and those of Carman and Miller be explained?

First, it would seem probable that the time elapsing between the ingestion of the gastroenterologist's meal and its withdrawal is too liberal, and that the stomach was empty in many cases, although an actual and pathological hypomotility existed.

Second, it is quite possible that the tube may have failed occasionally to bring up food remnants which were present.

Third, the tube may have failed to reach food retained in the lower loculus of an hour-glass stomach.

Fourth, marked differences as to the

	Hours	
Zone of Hypermotility	0	
	1	Early emptying, pathologic. (Nonobstructing gastric carcinoma. Duodenal ulcer. Diarrheic conditions.)
Zone of Normal Motility	2	Normal emptying. (A normal stomach functionating in a normal manner.) Early emptying, physiologic. (Hypertonic, steer-horn stomach.)
	3	Early emptying, pathologic, but slight, or partially compensated. (Duodenal irritation. Duodenal ulcer with obstruction sufficient to prolong the evacuation time to two hours in spite of associated hyperperistalsis, hypertonus and free pyloric patency.)
	4	Disordered motility with abnormal but balanced factors. (Stenosing carcinoma with achylia; average emptying time.) Delayed emptying, physiologic. (Hypotonic fish-hook stomach.)
	5	Delayed emptying, pathologic, but slight or partially compensated. (Slight stenosis. Stenosis with hyperperistalsis; evacuation retarded but within six hours.)
Zone of Hypomotility	6	Delayed emptying, pathologic. Stenosis.
	7	(*a*) Organic. (Obstructing pyloric carcinoma. Pyloric ulcer. Obstructing duodenal ulcer. Periduodenal adhesions, etc.) (*b*) Spasmodic. (Reflex pylorospasm from ulcer on the lesser curvature, cholecystitis, appendicitis, and remote abdominal lesions.)
	8	Etc.

quantity and character of the food taken by the patient may have affected the gastroenterologist's results.

Fifth, in exceptional instances of organic stenosis at the pylorus (cancer or ulcer) the tube found retained raisin-skins when the roentgenologic test failed to show a barium retention. It is clear that a stenosis might be sufficiently narrow to block the passage of these skins, yet permit a fair exit of finely divided barium.

Carman and Miller drew the following conclusions: (1) It would seem that the bariumized carbohydrate meal described above is a more sensitive test for gastric motility than the modified Riegel meal as commonly used in the Mayo clinic. (2) The roentgenologic double-meal method is more informative than tubing after a motor test-meal, since the former not only shows delay of evacuation beyond six hours, but also yields information as to hypermotile conditions, and often by showing both the active and passive factors concerned in motility, aids in the judgment of the net result. (3) A distinct residue after six hours from the barium meal given under the conditions prescribed has been, nine times out of ten, in our experience, indicative of grave pathology and usually denotes obstruction at or near the pylorus. (4) The roentgenologic method is probably capable of further elaboration and refinement. By this means the motility of the stomach for various foodstuffs, given separately and in combination, can be determined with ease and accuracy and by such determinations the diagnosis of gastric disorders might be further promoted. (5) The six-hour barium residue may be the most definite and striking roentgenologic sign of a gastrointestinal lesion. Other signs may be so slight and indefinite that a diagnosis might not be ventured without this retention. (6) Retention of the barium meal is often an important element in roentgenologic symptom-complexes as used in diagnosis. In the absence of other decisive Roentgen manifestations this finding may have considerable value in correlation with the clinical data.

Lazarus-Barlow, Dr. W. S., London, England: The action of radiations on cells and fluids. (The Lancet, Sept. 12, 1914.)

Barlow pointed out that the action of rays must be considered from two widely contrasting points of view, both having important bearings on clinical medicine. On the one hand, the effect of relatively large quantities of radiations was important, owing to the probability that radium (and he included mesothorium and X-rays) were destined to play a fundamental part in the treatment of new growths. On the other hand, the effect of minute quantities was important, because a claim had been made for their efficacy and the treatment of certain diseases on balneological lines. He pointed out that, owing to the better facilities, most of the information available in the Middlesex Cancer Research Laboratory dealt with the effect of relatively large quantities, but the fact that he had found minute quantities of radium in carcinoma tissues and in gallstones associated with primary carcinoma of the gall-bladder, and further that radium was very widely distributed in nature, he held to be indicative that even quantities so small as one hundred-millionth of a milligramme of radium might play a hitherto unsuspected part in disease and health. He reminded the meeting that the experiments of many authors showed that small doses of radiations were capable of inducing cell stimulation, whereas large doses induced cell degradation and death. He held that these experiments proved that radium might be applied in the work of the bacteriologist, hematologist, and the pathologist, whether dealing with the cell in health or the cell in disease, and he also touched upon the utility of radium and radiations to the work of the physiologist or pathological chemist, instancing the disintegrative power on H_2O, and the synthetic power in producing ammonia. He had recently examined the effects of radiations upon normal cells of the rat, notably the dry squamous epithelium of the tail, the moist squamous epithelium within the sphincter ani, and the columnar epithelium

of the rectum, by inserting the upper part of a tube containing $RaBr_2$ into the rectum and allowing the lower part to protrude from the anus. He ensured that each of these varieties of epithelial cells should be brought into direct action of a constant series of radiations for a definite length of time. At various times after the rats were killed an examination was made for histological changes. Two distinct varieties of exposure were made: (1) With a tube containing 38 mgr. of radium bromide, and (2) with a tube containing 92 mgr. One series of rats was subjected to 38 mgr. for thirty minutes, another series to 92 mgr. for 13½ minutes, and the rats were killed on the first, second, third, seventh, eighth and ninth days after. From the tables that he had drawn it would appear that after a single exposure with radium the results were different; (a) according to the type of epithelial cell under consideration, and (b) according to the arrangement of the "quantity X time," factors which went to make up the single application of radium. He showed also that a striking difference occurred in the behavior of the two varieties of squamous epithelium. The dry squamous cell was seen to be more vulnerable than the moist squamous cell. All these points were determined by the effect of radium in simulating mitosis. He suggested, however, that differentiations might be made between certain of the life processes of columnar cells, moist squamous cells, and dry squamous cells by means of radium; and that the recognizable histological differences between the types of fibrous tissue designated as subcolumnar (submucous) or subsquamous (subcutaneous) were to be associated with differences in their inflammatory responses to a physical agent. He grouped columnar cells with submucous tissue and squamous cells with subcutaneous tissue as complexes that must necessarily be dealt with in matters of treatment with radium—e. g., columnar cells, carcinoma, and squamous cell carcinoma, and he deduced from his experiments that in order to produce the maximum injury to epithelial cells and the minimum damage to subepithelial tissues different procedures must be adopted. Indications differed according to the size and situation of the growth; if the growth was small and submucous tissue was in close relation, the "time factor" should probably be kept as low as possible, whereas if the growth was large and submucous tissue was relatively at a distance, the "quantity factor" should be kept as low as possible, whilst the "time factor" should be raised. In dealing with a total action of radium dose eight times as great as those previously dealt with, he showed that "the time and quantity factors" played the contrasting parts already mentioned. He exposed one rat to 92 mgr. of radium for 108 minutes and another to 38 mgr. for 240 minutes, these doses being identical, considered on the lines of ionisation. The two rats were killed on the ninth day after ionisation, and showed widely different induced changes in the tissues. In the tissues exposed to 92 mgr. for 108 minutes the mucous membrane persisted, though there were inflammatory changes, whereas in the 38 mgr. for 240 minutes specimen the inflammation was such that the mucous membrane in contact with the radium tube and a little beyond had entirely sloughed away. But whereas in the case of the mucous and submucous portion a smaller quantity of radium acting for a greater length of time produced the more profound destructive changes, the exact converse occurred in the cutaneous and subcutaneous portion, where it was seen that the inflammatory reaction and destruction of squamous cells was greater in the case of the rat exposed to the 92 mgr. for 108 minutes. He concluded that undesirable damage was better eliminated by keeping the "quantity factor" of the radium dose high and the "time factor" low in the case of the columnar cell complex, but in the case of the squamous cell complex it was better eliminated by keeping the "quantity factor" of the radium dose low and the "time factor" high.

Lees, Dr. D. B., Cantab., F. R. C. P., London, England: Diagnosis of chronic pulmonary tuberculosis in infancy and childhood. (British Medical Journal, Sept. 12, 1914.)

The real existence of dull pulmonary and glandular areas is readily confirmed by a Roentgen examination. In every one of six cases of incipient pulmonary tuberculosis in which Lees had detected their presence, his colleague, Dr. Harrison Orton, without knowing his results beforehand, confirmed them by examination by screen and photograph. The last of the six was specially interesting, because Dr. Orton's verdict, based on the screen examination, appeared to contradict Lees' previous result by percussion, but when he took the photograph he found that it confirmed the facts revealed by percussion.

The peribronchial tuberculous fibroses and the swollen bronchial glands which are almost invariably present to a greater or less extent in children affected by chronic pulmonary tuberculosis form a very striking picture on Roentgen ray examination. But in order to secure a correct interpretation of what is thus revealed to us, it is necessary in the first place to remember that no sound conclusions can be based on a screen examination without the aid of a photograph. In one case a screen examination by Dr. Harrison Orton led to a conclusion which was reversed by a photograph taken on the same day. Even with regard to a photograph the highest technical skill is required if mistaken conclusions are to be avoided. All the apparatus must be of the best, and the exposure must be extremely short, for longer exposure makes the finest details obscure. And when a first-rate negative has been obtained the greatest care is needed for its correct interpretation. For in such a photograph the effects of morbid changes in different transverse vertical planes are all thrown on one plane and almost inextricably mixed. Not only so, but the mixed result will vary according to the angle which the sensitive plate makes with the chest wall at the time the photograph is taken—an angle which will be different in well developed and in ill developed chests. Thus, the fine "mottling" caused by incipient pulmonary tuberculosis at one of the areas may be projected on an entirely different area, and it may require the greatest care to disentangle them. Yet it is the fine "mottling" which should be searched for if we are to draw right conclusions as to the origin and progress of the morbid process. The thickenings around the bronchi which cause radiating lines and the gross changes at the roots of the lungs are far less important for a true understanding of the real course of the morbid process. In a large number of cases in which these root areas and radiating lines are the most prominent objects in a photograph, and the only definite results (except for defective lighting up of the apical regions and lessened movement of the diaphragm) that can be seen by the fluorescent screen, they may be really of very little present importance. For fibroid and calcareous changes may be quite quiescent, as Dr. Jordan has shown. It is the fine "mottling" which is all-important in the diagnosis of early pulmonary tuberculosis, and this is lost on the fluorescent screen and obtained with difficulty in a photograph, and even when obtained liable to be misplaced and therefore misinterpreted.

In each of three roentgenograms taken by Dr. Ironside Bruce from children in whom Lees had detected what appeared to him to be characteristic percussion evidence of past or present pulmonary tuberculosis, additional dull areas close to the spine at the third dorsal level seemed to indicate enlarged bronchial glands. The Roentgen report in each case stated that there was increased opacity in both lungs, often most marked towards the root, and in each case "small rounded opacities arranged in groups" were present, which are, at all events, very suggestive of tuberculosis. In one of these three cases the cutaneous reaction to tuberculin gave a positive result; the child died in hospital, but no autopsy was obtained. The other two cases recovered

sufficiently to leave the hospital; in one of these the cutaneous reaction to tuberculin gave a negative result; in the other it was not tested.

Bruce, Dr. W. Ironside, Aberd., Charing Cross Hospital: **Diagnosis of chronic pulmonary tuberculosis in infancy and childhood.** (British Medical Journal, September 12, 1914.)

Those familiar with Roentgen examination of the thorax cannot fail to recognize that this method of investigating the lung in pulmonary tuberculosis of childhood is of the utmost value. Fortunately, the lung is very easily penetrated by the radiation from the Roentgen ray tube on account of the large amount of air such tissues contain, and in consequence the slightest infiltration of the bronchi or substance of this organ by some opaque material, fluid or fibrotic in nature, produces alterations in the normal appearance of these structures which are easily recognizable. Tuberculosis infiltration of the lung is associated with blocking up of the alveoli by catarrhal products and the formation of fibrous tissue, and since fluid and fibrous tissue are much less permeable to the Roentgen ray radiation than normal lung, shadows must result when a photographic exposure is made, the distribution and shape of such shadows, as might be expected, being characteristic.

Diversity of opinion as to the exact appearance of tuberculous lung may be explained by variation in the technic employed. The chest may be examined first by the fluorescent screen, and secondly, by using the photographic plate. The screen is useful in viewing the movement of the diaphragm and heart, but the amount of detail available is very small.

Fine detail is absolutely necessary for the recognition of tuberculous infiltration of lung, and this can only be obtained by employing the photographic method. In order that efficient skiagrams may be secured, it is essential that the exposure be made without movement of the lung. When dealing with an adult all that is necessary is to instruct the patient to expand the chest fully and hold the breath, but with children it is a difficult matter to ensure the absence of movement of the diaphragm during the exposure, despite the fact that very short exposures are now possible. Improved instrumentation will, no doubt, abolish this difficulty, but in the meantime useful results may be obtained by getting the child to practice holding the breath before the examination. In this connection it is well to remember that instantaneous exposure, as now made, is only possible with the use of an intensifying screen or screens—a procedure which is followed by considerable graining of the plate and loss of detail sufficient to make such skiagrams of little use for the purpose under consideration.

Should it be found that the diaphragm has moved during the exposure, the result cannot be relied upon, for detail is lost in the most surprising manner, and a well-marked infiltration may be unrecognizable. In very young children occasionally the involvement of one lung results in inhibition of the movements of the diaphragm, and thus good detail is available.

With regard to the appearance of tuberculous lung in Roentgen ray examination: The *screen* shows that there is some limitation of the movement of the diaphragm on the affected side; increased opacity, most noticeable on comparing the lungs in this respect on inspiration, and general elongation of the cardiac opacity. The *skiagram* shows increased opacity of the affected lung, which is to some extent striated in arrangement, but is also made up of small rounded opacities arranged in groups.

There appears to be considerable difference of opinion as to the value of these signs individually. Thus, limitation of movement of the diaphragm may result from any inflammatory lesion of the lung or any such condition in the thorax or abdomen. The increased opacity of the lung on inspiration may be caused by the limitation of the movement of the diaphragm alone, or may

be due to inflammatory lesions other than tuberculosis. The elongation of the cardiac opacity, though indicating a tuberculous type of thorax, does not prove tubercle to be present.

The striated opacity noticeable in skiagrams may result from old inflammatory lesions, and may therefore be seen, and is certainly seen, in healthy subjects. The rounded opacities arranged in groups constitute an appearance which may be relied upon, except that it is difficult to distinguish active from inactive, simple catarrhal from tuberculous infiltration. For the recognition of tuberculosis of the lung all these signs should therefore be employed, and no single one of them be placed in the position of first importance.

In chronic tuberculous diseases of the lungs the typical appearances just described may undergo alterations, for when infiltration is dense the smaller rounded opacities may overlap and larger patches result, or it is possible that an area of the lung affected may become more or less uniformly opaque, though there always remains some degree of irregularity. When lung tissue has been destroyed and cavity formation has occurred, this process produces areas of great translucency, usually rounded in shape, and not unusually surrounded by more densely infiltrated lung tissue, which results in prominence of the translucent areas and sharpness of their margins.

Fibrosis of the lung, when extensive, results in displacement of the viscera towards the affected side, so that the contracted lung becomes uniformly opaque, recognition of the condition underlying the fibrosis being then dependent on typical appearances observed in part of the affected lung, or on the opposite side.

Pleural effusion, when present in quantity, produces total obliteration of all detail, and obscures the outline of the diaphragm and heart, the opacity thus produced being evenly distributed. The amount of fluid present may be estimated by examination in the erect posture, when its upper limit can be made out, or by noting the amount of displacement of viscera when the cavity is completely filled.

When pneumothorax occurs, the diaphragm on the affected side is immobile, and remains in the position of full inspiration, the collapsed lung being usually visible as a dense mass lying in the region of the root. Should a fluid effusion be associated with air in the pleural cavity, the condition of affairs is most beautifully demonstrated, for in the erect posture the upper limit of the opaque fluid is represented by a sharp horizontal line, the direction of this line being maintained notwithstanding alterations in the position of the subject. On shaking the patient the splashing movement of the fluid can be plainly seen with the screen. From a Roentgen ray point of view, chronic tuberculous disease may be confused with certain other diseases of the lung. Lobar pneumonia results in increased opacity of the affected lung, but this increase in opacity is uniform, lobar distribution often being indicated. When a small fluid effusion is present in tuberculous disease of the lung, the evenly distributed opacity caused by the fluid may be confusing, but examination in the erect posture and lying down will demonstrate movements of the fluid, and so serve to indicate the correct diagnosis. Should the fluid be localized, movement will not take place on change of posture, but fortunately under these circumstances the imprisoned fluid presents a sharp outline which is unmistakable.

Catarrhal pneumonia presents an appearance on Roentgen ray examination which may be very difficult to distinguish from that of tuberculous disease. Rounded opacities somewhat similar to those of a dense tuberculous infiltration are to be seen, but they are larger and usually more widely distributed. Pleural effusion is usually distinguishable, as already mentioned, by its movement on alteration of the position of the patient, but when occurring in conjunction with tuberculous disease all detail may be obliterated, a diagnosis being impossible unless the fluid is removed, or a typical lesion is present in the opposite lung.

The demonstration of bronchiectasis by Roentgen rays is most disappointing, for all that may be observed is a small amount of fibrous tissue formation represented by opacity striated in arrangement; should fluid remain in the cavities, large irregularly-shaped opaque patches result.

The appearance of an abscess of the lung is quite unlike that of tuberculous disease, for the former presents a localized area of opacity, which is not uniform and is most irregular in outline.

Hydatid cyst occurring in the lung produces a sharply-outlined shadow, roughly spherical in shape, and of uniform opacity, its appearance being quite unmistakable.

Thomas, Dr. B. A., and Pancoast, Dr. H. K., Philadelphia: The pathology, diagnosis and treatment of seminal vesiculitis. (Annals of Surgery, September, 1914.)

Collargol roentgenograms in a series of normal and pathological cases have demonstrated, (a) by comparison *in vivo* and *in vitro,* the graphic portrayal of an ejaculatory duct sphincter; (b) the intimate relationship between the ureter and seminal vesicle, whereby ureteral irritation and urinary obstruction may occur in the event of an enlarged and inflamed vesicle; (c) the presence of stricture or obstruction of the vas; (d) congenital anomalies of the vesiculae seminales; (e) inflammatory enlargements of the vesicles, especially loculated collections of pus or seminal pyovesiculosis.

Jordan, Alfred C., M. D., Camb., M. R. C. P., London, England: Chronic intestinal stasis. (Medical Record, N. Y., Sept. 26, 1914.)

When first Jordan took up this work, he was handicapped by the belief that the patient must be "prepared" for the bismuth meal by giving him purges and enemata, and that he must take his bismuth in the form of a "meal" while fasting. The best way to give the bismuth is in the form of an emulsion to be taken about an hour after an ordinary breakfast. In the vertical posture the emulsion is seen to pass through the esophagus rapidly, and to fall at once to the great curvature of the stomach. The patient then lies on the couch on his right side to allow the bismuth to fill the pylorus and duodenum. After a minute or so he lies on his back, and is examined with the fluorescent screen. In the normal case the duodenum is small and short, its vertical portion measuring 2¾ to 3¼ inches; in a few seconds a duodenal peristaltic wave starts near the top of the duodenum, and carries before it the whole contents of the duodenum without delay through its four parts and on to the jejunum. At the end of three or four hours there is no longer any bismuth in the stomach or duodenum; the whole of it is in the lower abdomen, partly in the lower coils of the ileum, partly in the cecum and ascending colon. In perfectly normal cases the lower ileac coils lie above the pelvic brim, and there is never a very large collection of bismuth in these coils, the passage through the ileocecal valve being free. One of the very earliest effects of stasis is to cause the lower ileal coils to drop into the pelvis. There is then a long rise from the pelvis to the cecum. Spasm of the ileocecal valve occurs, and adds to the difficulty. The last inches of the ileum become hypertrophied to a thick cord, which is easily felt. In many cases the weight of the overloaded cecum and ileum causes a constant pull on the mesentery of the ileum whenever the patient is upright; a thickening then appears in the mesentery at the point where the pull is greatest. The point of greatest strain varies from case to case; often it is within an inch of the ileocecal valve; sometimes it is in the right iliac fossa about four inches from the valve; in other cases again it is just above, or just below the pelvic brim.

It is clear, then, that the ileal kink is not the primary cause of the ileal stasis, although the kink, when present, aggravates the stasis, at any rate in the upright posture. It is the ileal stasis which produces the kink, by pulling on the mesentery of the ileum. Some of the worst cases of ileal stagnation

occur in feeble women, and in them a kink may never appear. In such cases there is often extreme dropping of the large intestine, the cecum occupying the deepest part of the pelvis. The ileal contents have not then to negotiate a rise to the cecum; the difficulty must be enhanced by the ileocecal valve, which gets into a state of spasm seldom fully relaxed. In normal cases the bismuth begins to enter the cecum in three to four hours; in six to eight hours it has reached the middle of the transverse colon; in eight to ten hours the splenic flexure, and in eighteen to twenty-four hours the rectum. At this stage (twenty-four hours) there is usually bismuth in all parts of the large intestine, fairly evenly distributed. At the end of forty-eight hours all the bismuth should have been evacuated. The delay in the large intestine in stasis is often extreme, and after one hundred hours there may be little bismuth beyond the splenic flexure. One of the most important is the effect of intestinal stasis upon the duodenum and the stomach. The changes revealed by a bismuth meal are most striking and characteristic. The duodenum is much too large; its vertical part measures four, five, or even six inches in length instead of 2¾ to 3¼ inches, as in healthy subjects. The duodenum is also much wider than normal; often it is double the normal width. Its first part in particular is often greatly dilated. It fills well with bismuth (provided the conditions be arranged suitably), but it does not empty itself into the jejunum with a single peristaltic wave as in normal cases; the "static" duodenum shows excessively powerful peristalsis, wave after wave passing along its four parts; one has only to look at it to realize that it is working against an obstruction; the bismuth is driven down to the lowest part of the duodenum, and often well on into the fourth part, only to return again, time after time, to the vertical part as each wave passes over. The whole duodenum alters in form continually during the occurrence of this phenomenon, giving the appearance of "writhing." In severe cases this "writhing" peristalsis continues hour after hour, a single spurt of bismuth finding its way through to the jejunum every ten minutes or so. The duodenum seems never to tire. The radiologist, while examining the duodenum, can actually see the bismuth forced into the fourth part of the duodenum, almost up to the junction with the jejunum; eventually some bismuth is forced through, and then the radiologist can see that the jejunum passes down vertically at its commencement. A few hours later he is able to convince himself that there is stasis in the lower coils of the ileum. Few things in medicine are more constant; if we find a distended duodenum we are certain to find ileal stasis, and conversely, if we find a normal duodenum, with free duodenojejunal junction we are most unlikely to find any material amount of stasis in the lower ileum. The distended duodenum causes no subjective symptoms, but if it is congested the patient becomes aware of its presence at once; he feels pain in this region, and there is tenderness to pressure over it; the tenderness is often attributed to the gall-bladder. If the duodenum has become infected with microbes from the stagnant ileum we shall probably get ulceration in the duodenum. No normal duodenum gets ulcerated; a chronic duodenal ulcer occurs only in the distended duodenum of chronic intestinal stasis. The distended duodenum has a very definite effect on the pylorus, which closes tight to prevent reflux from the overfull duodenum. The pylorus gets into a state of permanent spasm, its contents become too acid, and this leads to a further increase of the spasm. There is delay in the emptying of the stomach, and this organ is overloaded and dilates. The great curvature drops, and the transverse colon, also heavy with the weight of its stagnating contents, drops with it. Thus we get an abnormally great strain on the lesser curvature, and especially on the two "ligaments" of the stomach—the pylorus and the esophagus. A chronic ulcer is apt to appear at the pylorus, this part being accessible to the microbes which infect the "static" duodenum, or, if the pylorus drops, the point of greatest strain

is shifted toward the esophagus, and the ulcer appears at some point along the lesser curvature.

With the appearance of an ulcer in the stomach, the acidity of the gastric contents increases still more, and the pyloric spasm becomes so severe and constant as to simulate organic stenosis, and the radiologist must be very wary in the manner of carrying out his investigations to avoid this pitfall. The Roentgen ray appearances of chronic ulcer of the lesser curvature are quite characteristic, especially on the cough. The depressed base of the ulcer fills with bismuth; the raised margins of the ulcer are shown, and there is a tight hour-glass constriction of the stomach over the region occupied by the ulcer, so that the stomach appears divided into two parts, separated by a narrow isthmus. An important point to remember is that this hour-glass constriction is permanent except during general anesthesia. The radiologist must bear this in mind, lest he diagnose a cicatricial contraction, and the surgeon must not forget it, for when operating under general anesthesia he does not see a constriction, and he may not realize that the stomach will be drawn in again at the seat of the ulcer as soon as the patient has recovered from the anesthetic.

Can we show, by radiology, that the stasis has been relieved? Certainly we can; in a successful case the whole bismuth meal is in the rectum after six or eight hours. The stasis has been cured. If the large intestine has been left, there may be some bismuth in the descending colon for a few hours, but as soon as the patient has an evacuation this comes down and is passed with the rest. Some of the cases in which the bismuth passes back, not merely into the descending colon, but right back to the cecum, are those in which the subsequent removal of the big bowel becomes necessary on account of flatulent distension and tenderness due to the irritation set up in the bowel wall by the retention of lumps of secretion in the big bowel. Jordan has reinvestigated a large number of patients after short-circuiting, at varying intervals, from three weeks to several years, and the general conclusions are as follows: The duodenal obstruction, as shown by "writhing" contractions, and repeated return of the bismuth toward the pylorus, are relieved at once by the three or four weeks' recumbency following the operation, and do not come again even after the patient has resumed ordinary conditions of life and work. The duodenum does not return at once to its normal size, but gradually —in the course of months—it becomes smaller and shorter, though in old, neglected cases the duodenum tends to remain permanently more "baggy" than normal; but the chief point is that the duodenum never again becomes distended; it is no longer found full of bismuth; its outlines can be sketched only by observing small quantities of bismuth as they pass through it—which they do without delay—into the jejunum. No photograph of the "cured" duodenum can be taken, in marked contrast to the state of things before the operation, when a most striking photograph of the distended duodenum is readily obtained.

Another proof of the efficacy of the radical treatment is shown in the stomach which loses its constant pyloric spasm, so that the rate of emptying of the stomach becomes normal, or nearly so, within a few months after the operation.

De la Camp, O.: Roentgen therapy in experimental and human tuberculosis of the lungs (Neber Strahlentherapie der experimentallen und menschlichen Lungentuberkulose). Strahlentherapie, 1913, III, 546-550.

For the experiments rabbits were infected with tubercles of a culture of the typus humanus. One series of these animals was roentgenized at intervals of 8 to 10 days, beginning immediately after the injection. The focus distance was 23 cm., the hardness of the tubes 6 to 8 Benoist and the filter 3 mm. aluminum. The right and left sides, the back and the chest were exposed for a total time of 2½ to 3 hours each, with a total quantity of energy measured on top

of the animal of 25 to 30 X-Kienboeck, so that in eleven hours 109.5 X were measured on top of the animal and 30 X below. Comparing examinations of the lungs of roentgenized and not roentgenized animals showed no considerable differences.

When the same technic was repeated 4 weeks after the infection, and found to have no effect, a second series of infected rabbits was roentgenized with harder tubes and a focus distance of 20 to 22 cm., with one day intermission. For the application of these much higher doses, the specially constructed apparatus for deep irradiation of the Veifa Werke was used. The control animals showed the symptoms of progressed tuberculosis of the lungs with caseation, etc. In the roentgenized animals, macroscopically central necrosis of a more cartilaginous aspect with a shrunken demarcation was found. In place of the proliferating granulation tissue, new connective tissue was found around the necrosis, also sharply marked against the surrounding in contrast to the not roentgenized animals.

A third series of animals was roentgenized with the above mentioned greater surface energy immediately after the hematogenous infection. The following contrasts were found: Not irradiated animals after 4 weeks, macroscopically numerous small tubercles can just be recognized; microscopically they showed typical subpleural tubercles with beginning central caseation and a border zone rich on cells.

The roentgenized animals showed microscopically smaller foci, which had lost the character of the typical tubercle; with macroscopical examination of the lungs there could, in fact, nowhere tubercles be found.

From these animal experiments it may be seen that hematogenous tuberculosis in rabbits with properly dosed hard roentgenization, at the beginning of the development as well as in the fully developed stage, may be influenced. With the beginning tuberculosis we deal with a fibrous metaphysis of the growing tubercle; in the developed stage with a substitute of the proliferation border zone by a young connective tissue with sharply marked borders against the sound tissue. A direct influence upon the tubercle bacilli could not be ascertained; the experiments with larger parts of lungs of the roentgenized animals were positive.

Founded upon these animal experiments, larger Roentgen doses were also applied on tuberculous man. The following table shows the time of exposure, dosage, etc., on 15 patients after about ½ year treatment:

No.	Stage.	Duration of Treatment			Time of Exposure in Minutes	Surface-Quantity After Kienboeck
1	II	IV.	8-VI.	31	1048	471 X
2	I	IV.	8-IX.	5	1060	524 X
3	I	IV.	12-IX.	5	1013	566 X
4	II	IV.	15-IX.	5	1081	613 X
5	I	IV.	16-V.	14	680	347 X
6	III	IV.	16-V.	20	710	348 X
7	II	IV.	20-VII.	14	810	549 X
8	III	V.	3-VI.	11	580	314 X
9	II	V.	19-VII.	4	440	336 X
10	II	V.	19-VI.	17	420	302 X
11	I	VI.	26-IX.	5	628	476 X
12	III	VI.	26-VII.	10	275	285 X
13	III	V.	26-IX.	5	981	793 X
14	II	VI.	13-IX.	5	687	398 X
15	II	VIII.	4-IX.	5	562	356 X

Of these 15 cases, four were in the first, seven in the second and four in the third stage after Turban. The roentgenization was performed under constant consideration of temperature and general conditions, weight, blood picture, the percussorial, auscultatorial and roentgenologic findings. The cases of the third stage did not improve and showed, on the contrary, a marked sensitiveness towards larger doses. In the cases of the first and second stage, clinical symptoms of improvement were noticed generally. The temperature showed, as a rule, a reaction increase after a reaction decrease. This appeared more pronounced after each roentgenization, so that a decrease to normal was obtained after some weeks. The blood picture was different in each individual case, a decrease of leucocytes was effected only by very large doses, secondary symptoms, as loss of appetite and vomiting, were observed only in very severe cases and these disappeared soon after roentgenization.

With careful application of large doses of hard Roentgen rays, a favorable influence in tuberculosis of the lungs can undoubtedly be effected. If, however, on the one hand a certain high dose is necessary, a too intensive irradiation on the other hand is not without danger; this is seen in patients in stage III, and also in a number of animal experiments, in which, after daily application of very large doses, the favorable influence of the tuberculosis process did not appear, and instead an inclination to peripneumonic symptoms.

An influence of the Roentgen rays upon experimental as well as human tuberculosis is proved by the above, but the technic requires an individualizing character and a long observation and experience.

According to our experience also, mesothorium has a favorable influence upon tuberculosis infected glands, so that perhaps the combined application of Roentgen rays and mesothorium or cholin and thorium X injections, or with other chemotherapeutic principles, may have good results and work in this line is under way at Freiburg, I. B.

Zimmern, A. and Cottenot (Paris): Roentgen-treatment of the glands with inner secretion in a condition of hyperactivity (Roentgen-behandlung der Druesen mit innerer Sekretion im Zustande der Hyperaktivitaet). Fourth International Congress Psychotherapy, Berlin, 1913. Strahlentherapie, 1914, IV, 305-311.

All glands with internal secretion are accessible to roentgentherapy. They seem to be more resistant to the effect of the Roentgen rays than the glands with external secretion. Thus, for example, in genital glands the internal secretion persists whilst the sexual function has disappeared long ago.

It seems that in a condition of hyperactivity the gland is more sensitive to the Roentgen ray than in normal condition, and in that case roentgentherapy has a greater effect.

Ovaries. Some authors are of the opinion that the Roentgen rays work as well upon the ovaries as upon the myomata themselves; most of them, however, agree with Albers-Schoenberg and Bergonie, that they affect the ovaries only. The genital glands are extremely radiosensitive; by roentgenization of the testicles the spermatogenies are destroyed and the formation of spermatozoa is prevented; in the same way the irradiation of the ovaries causes a degeneration of the follicles of Graff and sterility is the result, as Halbers-Toedter has shown by experiments. The disappearance of the myoma is therefore the result of an artificial menopause. With roentgentherapy we never find the severe disturbances by insufficiency of the ovaries as frequently met with after surgical castration. Adipositas, trophic disturbances or psychic asthenia have never been observed.

The most constant result of irradiation of the myomata is the cessation of hemorrhages, which Kroenig and Gauss have found in 90 per cent. of all their cases, and which occurs sometimes after a few weeks, mostly, though, within two to three months. The symptoms of compression, pains and edema disappear simultaneously. A decrease of the size of the myoma or its disappearance, which has long been doubted, is ascertained by the publications of Albers-Schoenberg, Bergonie and Bordier.

Thyroid Gland. Large quantities of Roentgen rays are necessary to diminish the physiological function of the thyroid gland. A peculiar observation of Acchiote shows that there may be a particular radiosensibility of that gland in some cases. In a patient who was roentgenized for hypertrichosis of the chin, occurred myxodematous disturbances, swelling of the face and the upper extremities, prostration and somnolence. By organo-therapy these symptoms were fortunately eliminated. One of Bergonie's and one of Courtade's patients who were roentgenized for Basedow's disease showed symptoms pointing to hyperthyroidism.

Zimmern and Battez provoked, experi-

mentally, disturbances by intensive roentgenization of the thyroid gland of rabbits, disturbances similar to those after extirpation of the thyroid gland, as falling out of hair, difficulty in breathing and decubitus. Quite considerable destructive lesions of the gland were found histologically.

For struma simplex, the result of roentgentherapy was absolutely negative, though Freund and Schiff had temporary results. Quite different is the roentgentherapy for Basedow. In 1902 Williams published the first good result of roentgenization for Basedow and after him Beck reported considerable functional improvement of a patient by this therapy. Statistics show that the nervous symptoms improved in 51 per cent., after that the tachycardia and then the tremor. An increase of weight was manifest in half of the cases. The goiter and the exophthalmus itself are seldom considerably modified.

The result of roentgenization is varying for Basedow, just like other treatments. P. Marie, Clunet and Raulot-Lapointe had remarkable results with hard rays and very high doses. The symptoms first grew worse, then after a latency of from two weeks to two months the symptoms lessened and the circumference of the neck decreased.

The irradiation of the thyroid gland has undoubtedly an influence upon the general nutrition, as found by Ruediger. Falta found a decrease of glucosuria in a diabetic Basedow patient.

Hypophysis. In only two cases roentgentherapy was tried for hypertrophy of the hypophysis; these are the cases published by Gramegna and by Beclerc, which were both published in January and February, 1909. The patient of Gramegna was suffering from acromegaly, with symptoms of intracranial compression, as headache and disturbance of vision by compression of the chiasma. An improvement was effected, but was not permanent; roentgenization improved a severe relapse, but failed to do so in a third relapse. Beclerc had better results. In a young girl with gigantism, he stopped the growth by roentgenization and was able to improve the symptoms caused by the cerebral tumor, and especially the disturbances of vision. There seems to be hope to be able to stop the development of acromegaly and gigantism by influencing the hyperactivity of the hypophysis by roentgenization, especially if there is opportunity to treat the cases early.

Thymus. Heinecke, Aubertin & Bordet, Regaud & Cremieux effected an atrophy of the thymus in young animals by roentgenization. Only small doses were needed because the gland is very radiosensitive. Cremieux recommends this therapy for thymus hypertrophy in children, as it is just as effective and less dangerous than thymectomy. Eight cases were thus treated by various men. Dyspnœa and cyanosis are lessened after a few days and then disappear completely.

Adrenal Glands. By a number of articles during the last years the important part which the hypersecretion of the adrenal gland plays in the pathogenesis of arteriosclerosis and the increase of arterial blood pressure was discovered. The authors thought, therefore, that it might be of use to try to limit the secretion of the adrenal glands in patients with increased blood pressure with the aid of the Roentgen ray, and the results justified their expectations. Twenty-nine patients were treated in this manner. In the majority of cases the blood pressure went down for from one to seven cm. quicksilver. In only four patients of the 27 the blood pressure remained unaltered. During the treatment the patients change nothing in their mode of living or in their diet, and especially there is no medical treatment whatever given. This improvement continued in some patients for seven months, in others the treatment had to be repeated to prevent new increase of the blood pressure. The functional disturbances improved at the same time; headaches, dizziness and paresthesia disappeared regularly. Fifteen of the patients suffered from increase of blood pressure without atheromatosis and without lesions of the adrenal glands and in these cases the results

were excellent. In one patient the blood pressure went down from 24 to 18 cm. quicksilver in a few days; the dizziness stopped. Another patient with angina pectoris lost his crises and his blood pressure went down from 20 to 15. In a second group of seven patients with atheromatosis, increase of blood pressure, without lesions of the adrenal glands the results were less favorable, though the blood pressure decreased in six of the cases. The other cases concerned patients with albuminuria, and no decrease of the albumen could be effected with roentgenization of the adrenal glands. In a first group of four patients with albuminuria and increased blood pressure the latter was diminished but the functional disturbances did not improve. The three other patients were arteriosclerotics with albuminuria and neither the general condition nor the blood pressure was in any way influenced by roentgenization, and roentgentherapy is therefore considered contraindicated in such cases, as well as in those where there are other complications, because a diabetic patient with increased blood pressure showed increase of sugar secretion after irradiation, though the blood pressure went down from 25 to 20 cm. quicksilver.

The technique was very simple. Very hard rays, 9-10 degrees of the Benoist radiochronometer, were applied under a filter of 1 mm. aluminum 3H at every sitting. The sittings are repeated in such manner that 6= or more are applied in one month.

The article closes with a report of experimental examinations on dogs.

Rostoski: Roentgentherapy for tumors of the lungs and mediastinum (Ueber die Behandlung von Lungen- und Mediastinaltumoren mit Roentgenstrahlen). Muench. med. Wchnschr., 1914, LXI, 676-677. (Gesellschaft fuer Natur- und Heilkunde zu Dresden.)

The author had a case of mediastinal tumor in 1910, which improved rapidly upon roentgenization. The good result induced him since then to try roentgentherapy in every case of tumors of the cavity of the thorax, and he reports 14 cases.

The intensive irradiation was at that time unknown and even later on the intensive therapy was not employed to such extent as is done today, especially in gynecology. Instead of that the treatment was continued for a long time. The technique was in general as follows: He worked with an inductor of Koch and Sterzel, with a spark length of from 50 to 55 cm. Hard tubes, two to two and a half and three milliampere (7-8 Walther) with a focus distance of twenty to thirty cm. were used, the time of exposure being five to eight minutes. For filters sole leather and later 1 mm. aluminum were used and for the last sessions 3 mm. aluminum with long single irradiation, and field irradiation or so-called cross fire. The single dose was 3-4 X or 2-2½ h. During a year he gave up to 50 to 60 irradiations. The sittings were held generally during the first three to four days of the week and so from three to six weeks in succession, then came a longer interval.

Concerning the results the author emphasizes that he was able to avoid injury to the skin and only a passing erythema or light pigmentation of the skin was observed. The cases should be divided into three groups: (a) an excellent result was obtained in three cases, 1, a case of tumor of the right lung which had been diagnosed four years ago and in which a diminution of the size is seen in the roentgenogram with improvement of the subjective troubles and especially of the dyspnœa; the patient was able to take up his occupation. If the symptoms appeared again, the treatment was renewed, and always had good success. A second case concerns a mediastinal tumor which was diagnosed three years ago; the patient is without troubles, but a quarter of a year ago metastases of the glands appeared in the left fossa supraclavicularis, which disappeared completely after eight roentgenizations. The third case deals with carcinoma of the mamma with metastases of the pleura and lungs, which came to the clinic in a desolate condition. The

tumors went surprisingly quickly back and the patient was free from symptoms for five months and would probably have remained so if she had come in time for a second treatment; as it was, she came too late, the roentgenization had no result and the patient died with metastases also in other organs. (b) In seven cases the disease was favorably influenced in so far as cough, expectoration and dyspnœa lessened, the patients were without trouble and in three cases the lives were undoubtedly prolonged by the treatment; in the roentgenogram an improvement could not be ascertained. (c) In four cases there was absolutely no result.

Microscopic examination of the tumors of those patients who came ad exitum showed that the tumor tissue was not different from that of those tumors which have not been roentgenized. Roentgenograms of the patients before, during and after the roentgenization are shown. In the discussion is nothing of roentgenologic interest.

Rubaschow, S. (Moscow): Roentgen diagnosis of biliary calculi (Zur Roentgendiagnostik der Gallensteine). Fortschr. a. d. Geb. d. Roentgenstr., 1914, vol. XXI, p. 533-536.

We have two kinds of biliary calculi, the evenly dense stones of oval or round form, and stones which are lighter in the middle and therefore show the shape of a ring or circle in the roentgenogram as first described by Albers-Schoenberg. The impermeability is less in gallstones than in kidney stones; it seems, therefore, advisable to employ the double plate procedure of Koehler for reproductions of gallstones. The size of in vivo roentgenographed gallstones varies from the size of a pinhead to the size of a linseed kernel; also the number of stones is varying; single stones appear seldomly. Characteristic of gallstones is the grape-shaped grouping of the shadows, which allows to localize the calculi with absolute certainty in the gall bladder; a single stone is mostly found in one of the large bile ducts. Upon the plate the calculi appear between the eleventh and twelfth rib; their distance from the spinal column is greater than that of the kidney stones. Sometimes the calculi are seen in the shadow of the liver but more frequently outside of it.

For differential diagnosis it is important that the shadows of the biliary calculi are more dense, have a characteristic form and lie generally nearer to the spinal column. The procedure of Beclerc, to make two pictures, one dorsoventral in which the biliary calculi appear smaller and more distinct, and a ventrodorsal in which the kidney stones appear sharper and more distinct. Content of the bowels and foreign bodies come not under consideration. Deposits of lime in the cartilage of the ribs are marked by their distinctness and longitudinal form and their arrangement. Ring-shaped biliary calculi might be mistaken for calcified lymphatic glands, which sometimes also show a lighter shadow in the center, but which are nearer to the spinal column and are never arranged like grapes.

Most frequent are the so-called mixed biliary calculi, which consist of cholesterin, bilirubin-Ca and calcium salts; their reproduction depends on the content of calcium. Extra corpus roentgenographed biliary calculi showed very plainly on the plate and contained much calcium in the majority. Of the stones which are deficient in lime the large ones which contain 60 to 70 per cent. bilirubin-Ca and those which on account of their diameter show a denser shadow and numerous stones which are arranged in layers in the gall bladder can be reproduced. Calcium stones, which are seldom found, give the clearest shadow in the roentgenogram.

The technique is as follows: Stomach and bowels should be empty, and not, as Beclerc advises, be filled with air. The patient lies on his back with the Roentgen tube under him. In the region of the gall bladder a compression is exercised from above and the photographic plate in this manner more approximated to the stones. This can be done either with a compression

tubus into which a small plate is placed or with a specially constructed cassette which is pressed upon the abdomen. This arrangement has proved very satisfactory even with very stout people. Roentgenograms which were made without compression showed but very little.

Pfoerringer (Regensburg): The application of strongly filtered Roentgen rays in surface therapy (Zur Verwendung stark gefilterter Roentgenstrahlen in der Oberflaechen-Therapie). Fortschr. a. d. Geb. d. Roentgenstr., 1914, XXI, p. 557-558.

Some carcinomata of the skin are refractionary against the Roentgen ray and it was tried to increase the sensitiveness of such tumors for Roentgen rays with eosin and quinine, or by freezing them with carbonic acid snow, or by giving a preliminary irradiation with the quartz lamp, and applying strong doses of Roentgen rays after an erythema had formed. In vol. II of the Strahlentherapie Regaud and Nogier pointed out the strong biologic properties which large doses of Roentgen rays which have passed through filters of from three to four mm. aluminum filters develop in surface therapy. With Roentgen rays thus filtered even persistent epitheliomata can be healed without damage to the skin. Strongly filtered rays have an elective effect upon the tumor cells and allow a smooth scar formation, whilst unfiltered rays work like a raw caustic and destroy sound and diseased tissues equally. The best method for the treatment of new formations of skin are very high doses of Roentgen rays which are strongly filtered.

Pfoerringer has tried this method in a case of carcinoma of the back of the hand, which had grown upon an old scar and reached the size of a silver dollar, and in a case of carcinoma of the bridge of the nose. In both cases he applied once in one sitting and once in two sittings, a total dose of 15 H. filtered through 3 mm. aluminum. The success was excellent. After two weeks the borders of the tumor were flattened and after six and eight weeks both cases were completely healed; in none of the cases was there a reaction or an erythema, the skin having remained completely unchanged.

He further treated a carcinoma of the lower lip, a carcinoma of the nose and a carcinoma of the inner eye angle which had spread over both lids. In the latter case the bulbus was protected by a thick plate of staniol, which was placed over the cocainized eye. In all three cases the healing took place after six weeks without any reaction. Especially the last case was a success, because with the formerly applied method of unfiltered roentgenization and more than a full dose a severe reaction on the eye would have been unavoidable; with the strong filtration, however, the carcinoma disappeared without any inflammatory changes on the lids, the conjunctiva and the bulbus, and also the vision of the eye had not suffered. The only disadvantage was that the cilii were lost in the middle third.

Regaud and Nogier recommended the application of strongly filtered Roentgen rays also for hypertrichosis and they are convinced that the elective treatment of the epidermis will be of importance for the perfection of roentgentherapy for various diseases of the skin.

The author had a case of chronic scaling eczema of both palms with unbearable itching. By application of hard unfiltered rays of three and later four H. the disease was promptly removed without reaction, but after three or four weeks the hands began to scale and to itch again; higher doses on the hands seemed too risky and Pfoerringer tried the application of 10 H. with 3 mm. aluminum filter, with the result that the itching stopped and the hands became smooth; for three months has no relapse occurred.

Finally the method was employed in a case of circumscript lupus of the face which by unfiltered small doses was but little affected; after application of 12 H. through 3 mm. aluminum the face healed reactionless.

The application of large doses of strongly filtered Roentgen rays has a favorable influence not only upon new formations of the skin, but also upon the various diseases of the skin. A disadvantage is that the method requires much time and spending of much radiating energy.

Wossidlo, Erich (Vienna): Experimental study on collargol filling of the pelvis of the kidney (Experimentalstudie zur Kollargolfuellung des Nierenbeckens). Arch. f. klin. Chir. 1914, CIII, p. 44-72.

In the literature only few reports of anatomical lesions as result of collargol injections into the pelvis of the kidney are found. Wossidlo made extensive experiments with animals and comes to the following conclusions:

A quantity of collargol which does not exceed the normal capacity of the pelvis of the kidney does not penetrate into the substance of the kidney. If this limit is nearly approximated or transgressed we may find traces of collargol, though only in small quantities, preferably in the tissue gaps of the interstitial tissue and in the canaliculi near the pelvis of the kidney. As soon as the injected quantity exceeds the capacity of the kidney to a higher degree, then the collargol impregnation of the kidney tissue in the tissue gaps of the interstitial tissues which were mostly enlarged by the trauma and of the destruction foci is so much greater and extends generally along the vessels. These changes become still more severe if a lesion of the kidney substance has occurred from the pelvis of the kidney.

It is different with kidneys in which an increased turgor of the tissue exists; even with an overfilling only small quantities, which are practically = O, are penetrating and the collargol finds a way into the surrounding connective tissue.

In kidneys where a pathologic enlargement of the canals has pre-existed, the collargol penetrates into the canaliculi in which we can follow it up into the cortex.

When the silver masses remain for a longer period in the tissue we may find phagocytic processes, but no pictures are found which would allow a conclusion upon a phagocytic transport. The demarcation area of the infarct where this might be expected, did not show any phagocytic processes upon very careful microscopic examination; there was no silver in the innumerable leucocytes.

It is Wossidlo's opinion that the findings in the human kidney, as reported in a case of Schwarzwald, are uniform to the findings in the author's animal experiments. In Schwarzwald's case, though, the collargol penetrated on pathologically diseased points which were of a more acute inflammatory nature (pyelonephritis). From the experiments we may draw the lesson that we should never transgress the limits of the capacity of the kidney with collargol injections, be these done for therapeutical purposes or only for pyelography, and that in cases of hydronephrosis never more should be injected than the quantity of the remnant of urine which has flowed out, amounts to. He goes even farther and demands that not even the limit should be quite reached, and that, as soon as the patient announces a feeling of tension—which is the only symptom of the complete filling of the pelvis—not only the injection should be stopped but also a quantity of the injected collargol should be allowed to flow out. Of course, the pyelographic pictures will then be less distinct, and he upholds this demand even though only very few cases of anatomical lesions of the kidney as results of collargol injections have been reported.

No collargol injections should be performed, if there be a secondary flow of blood from the catheter of the urethra, i.e., if the former catherization has emptied clear urine free of blood, because there is danger of the collargol penetrating into the kidney after a lesion of the same from the pelvis. Even with primary hemorrhages present no collargol filling should be made, because there must be in the kidney somewhere a locus minoris resistentiae from

which the blood comes. Here, above all, stones, tuberculosis and tumors must be considered, in which cases we mostly renounce upon pyelography.

The experiments, as the author says, are incomplete, in so far as no cases of severe suppurating diseases of the kidneys are figuring in the material, and he expects to publish a supplementing series of experiments in the near future.